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Vol. XXXII., No. 1.]

JANUARY, 1935.

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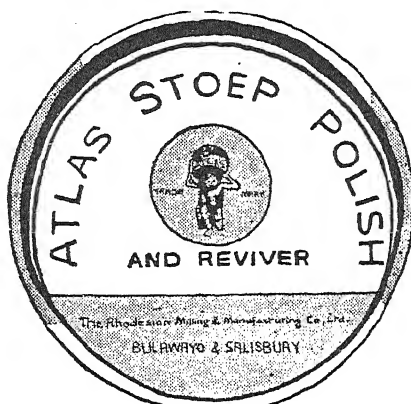
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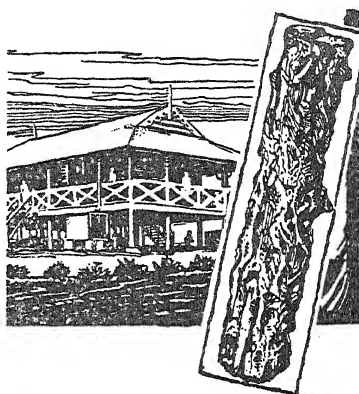
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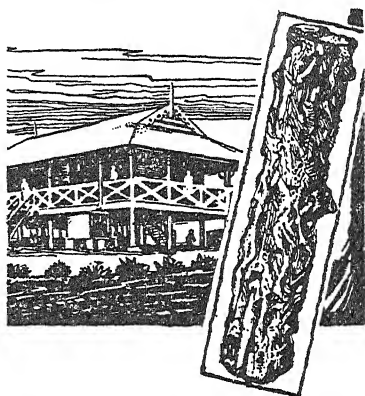
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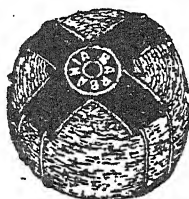
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VOL. XXXII.]

JANUARY, 1935.

[No. 1.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Mustard Oil a Preservative.—The effects of various spices, condiments, herbs, and their oils on the fermentation of beer wort by bakers' yeast at room temperature were recently studied by Messrs. Corban and Edgar under varying conditions of concentration and length of time. Of the species ground mustard was the most effective preservative, followed by cloves and cinnamon, with little or no preservative action for the other spices tested. The herbs examined, which included thyme, bay leaves, marjoram, savory and rosemary, appeared to stimulate yeast action, and this was also true of black pepper. The volatile oil of mustard was by far the strongest preservative of the oils, followed by cinnamon oil and then by oils of cloves, thyme and bay leaves, which were of approximately equal potency. The other oils tested were of

little or no value. Mustard oil in a concentration of 500 p.p.m., which is about the minimum amount used in salad dressing and mayonnaise, proved to be a more effective preservative as thus tested than sulphur dioxide and benzoic acid in the concentrations allowed (England) for fruit juices, 600 and 350 p.p.m., respectively.

With a concentration of yeast of 0.5 per cent. and of preservatives of 1 in 10,000, the loss of glucose with volatile oil of mustard was 0, with sodium benzoate 82 per cent., with potassium metabisulphite 81, and with no preservative 82 per cent. It is noticed that the concentration of sulphur dioxide used is of the same order as that allowed in sweetened mineral water and soft drinks.

Appointment of Plant Pathologist.—Mr. G. M. Wickens has recently been appointed to the post of Assistant Plant Pathologist in the Department of Agriculture. He received his initial training under Professor John Percival at the University of Reading, England, where he obtained a first-class Honours B.Sc. degree in Agricultural Botany. For the next three years Mr. Wickens studied plant pathology at the Imperial College of Science and Technology, South Kensington, as a Ministry of Agriculture Research Scholar. His principal line of study was the wilt, stem-rot and dieback of carnations which was causing very severe losses to the carnation growers round London. As a result of his researches radical changes were made in the methods of cultivation employed, and until he left for overseas the services of Mr. Wickens were retained by the growers under a research fund built up by voluntary contributions from those interested in the carnation industry.

Before leaving England Mr. Wickens submitted these for the degree of Doctor of Philosophy (London) and for the Diploma of the Imperial College.

Pretoria Milk Union.—A year ago the majority of the milk producers around Pretoria co-operated to form the Pretoria Milk Union Ltd., and to-day the membership has reached one hundred and twenty-eight. Although registered under the

Companies' Act it is in effect a true co-operative concern. The objects of the company were not to earn profits for its shareholders but rather to endeavour to so regulate the distribution of the fresh milk coming into Pretoria that all those engaged in the local whole milk trade might derive a reasonable return for their labours without in any way exploiting the consumer.

When the company started it was decided to fix the minimum wholesale and retail prices, and these have been maintained throughout the year as follows:—Per pint delivered, 3½d. up to 7 pints; from 1 to 2 gallons 2s. per gallon; over 2 gallons and up to 5 gallons 1s. 9d.; over 5 and up to 10 gallons, 1s. 6d.; over 10, 1s. 4d. per gallon.

By far the greater majority of the members of the Union loyally adhered to these prices. However, a few *producers* would not join the Union for various personal reasons and they in turn managed to maintain certain *distributors* who were undercutting the loyal members of the Union. At that time the Union controlled approximately 4,000 gallons daily coming into the city.

Generally speaking little difficulty was experienced in maintaining the prices fixed by the Board. In several instances loss of custom was reported, but after examination it was found that practically in all instances the increase in the retail price, together with added custom, more than set off any loss which was at first anticipated on account of the loss of original custom. In a few isolated instances a little hardship may have been experienced, but on the whole the conditions in the trade became more stabilised and certainly better than they had been for several years.

American Agriculture.—The following is taken over from "Notes on Feeding" in a recent number of *The Journal of the Ministry of Agriculture*. "Anyone oppressed by the thought of England's woes would be well advised to read the latest report of the United States Secretary of Agriculture. Coldly, fearlessly scientific in form, masterly in its stark brevity, it conveys a harrowing picture of a great industry at grips with a monster Surplus—now wallowing in seas of wheat, now smothered beneath mountains of cotton, now staggering amidst hosts of hogs unmanageable as the Gadarene's.

"The symptoms resemble our own; clearly also many of the difficulties encountered in national planning in this country have their counterpart in America. Interference in the complicated mechanism of private trading introduces ever-widening circles of difficulties.

"There is, however, this fundamental difference between America's agricultural problem and our own. Our planning is based on the belief that increased agricultural production is desirable; America's on the certain fact that reduced production is imperative. Agricultural surpluses in Europe have been met by the imposition of tariff and other barriers; the easterly-rolling tide recoils, and American markets are hopelessly submerged. For this there is but one remedy. A strange atmosphere, therefore, surrounds the later pages of the report; the tale, so seemingly familiar, becomes suddenly unreal; one is transported in a moment from the dismal world of economics to the realms first discovered for us by Alice through the looking glass..

"The main motif of agricultural education in this country has been, and still is, increased output. Critics there have always been, ready to tell us that increased output did not necessarily connote increased profits to the producer. Further than that, the most carping critic could not go; for one has been prepared to argue the positive proposition—that reduced production was necessarily better economy. Into some such position, however, is American science forced at present. There is, as of old, the desirability of increasing output per unit of effort; but somehow this must be accomplished within a lessened framework of national output. Thus it comes that the farm agents in 2,300 counties, together with Federal and State specialists and administrative staffs, have thrown their whole energies into reducing the output of cotton, hogs and other agricultural products; thus, also, we find the Secretary reporting that "experiments to determine the relative production of dairy cows on a ration consisting of roughages alone, as compared with a full grain ration, continue to show that cows, when receiving a good quality hay, are capable of fairly high levels of production at economical costs, without the addition of other feeds to the ration.

"These results, together with data showing the comparative cost of producing nutrients in the form of grains and hays, indicate that the farmer who grows all the feed for his livestock will make more money if he grows and feeds all of the ration in the form of roughage, even with the lower production from his cows. This appears to be a practical method of slowing up the production of dairy products and at the same time increasing the profits of the producer."

Export of Frozen Porkers.—The first consignment of frozen porkers has now been got together and will be despatched early in January. Applications are invited for a second consignment, which will be despatched early in February if sufficient support is forthcoming. Applications stating the number of pigs available, the breed, age and approximate weight, must reach the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury, not later than the 7th January, 1935. All applicants will be advised as soon thereafter as possible whether the shipment is to be proceeded with or not. First quality porkers, 90-100 lbs. liveweight on the farm, are required, and the pigs must make these weights during the period January 15-31st inclusive. The pigs will be inspected on the farm, and if suitable, purchased at a price of 4½d. per lb. liveweight at the factory, railage paid. Other things being equal, preference will be given to farmers in the vicinity of Salisbury or Bulawayo and close to rail and to those who can offer suitable porkers in lots of seven pigs or more. It is considered that when the results of these two shipments are known the information available, in conjunction with last year's shipment, will be sufficient to state fairly definitely what the possibilities of the trade are as far as this Colony is concerned. A full report of the next shipment will appear in the *Journal* as soon as available.

Curing of Hides.—An important experiment in the curing of hides has just been completed by this Department in co-operation with the Rhodesian Export and Cold Storage Company. There is a tremendous annual loss in the curing of Rhodesian hides. Much of this loss is preventable. These

experiments are designed to develop a simple method of farm curing applicable to farms and to natives in the native reserves. One hundred and twenty-five hides have been cured in five different ways. The hides will now be despatched to the United Kingdom for report, both from the tanners and the Hide Committee of the Imperial Institute. The local reports on these hides are promising. The full report will be published later in this *Journal*.

The following is a letter from A. S. Laurie, Esq., of Somerset Farm, Amandas. The views of farmers will be appreciated.

In Southern India, where Kaffir corn is very extensively grown, I very often heard it stated by the Indians that Kaffir corn is a grave source of danger to livestock during the following stages of its growth:—

1. In its early growth until it reaches a height of about 3 ft.
2. Any time when it shows signs of wilting.
3. When it throws out fresh shoots after being cut down.

A treatment given to animals showing signs of poisoning from eating Kaffir corn which is said to be very effective is, to drench the animal with milk, or failing this, to give it a good drenching of sugar and water thoroughly mixed.

I cannot say from my own experience what truth there is in the above statements I had brought to my notice, but it may, if tried, prove most useful to livestock owners.

I suggest that the information be passed on to them and they be asked to inform us if it is reliable, especially in so far as it relates to treating poisoned livestock.

Vlei-land Grasses.—An enquiry was received regarding vlei-land grasses, and it is felt that the following reply by the Agriculturist may be of general interest.

In reply to your enquiry regarding vlei-land pastures in Southern Rhodesia, I would advise you in the first instance to prepare the vlei-land a season in advance to permit of the

thorough decomposition of all vegetation turned under, and further, to allow the soil to sweeten up. A dressing of lime would undoubtedly assist in this process. Many failures to establish vlei pastures from seed is attributed to the fact that the soil is too acid and ill-drained, and, therefore, cannot provide the congenial medium for young grass seedlings.

Drainage.—Bulletin No. 860, “Soil Drainage and Utilisation of Vleis,” should be obtained and studied. Suitable types of drains are discussed which effectively dispose of flood and standing water. The shallow and wide drains recommended allow sowing down to *Paspalum dilatatum*, and the cover thus provided in the bottom of the ditch checks all possible erosion, and further, no land is wasted, every possible inch being available pasture.

Possibilities.—Vlei-land is by far the most valuable land on any Rhodesian sand veld farm, and if given proper and thorough treatment can be converted into valuable summer and winter pasture, providing succulent green grass throughout the year. If it is worth having when the rest of the countryside is dry and practically useless, then it is worth fertilising. Its return to the owner will be strictly in proportion to the time, care and fertiliser treatment given by him to its preparation and subsequent treatment.

Grasses.—The results of experiments conducted by this Department indicate that our most useful vlei grasses on sand veld vlei formation are (1) Swamp Couch (*hæmerthria fasciculata*), one of the best, if not the best, grazing grass for waterlogged pastures. (2) *Paspalum scrobiculatum*; this grass is frequently to be found closely associated with swamp couch grass and on the same class of land. Both are indigenous to Rhodesia. The latter occurs freely on low lying land of contact formation. (3) *Paspalums larranagai* (Upright) and *P. dilatatum*.

Of the three paspalums, *scrobiculatum* is the one most relished by stock, it is more succulent and upright in growth than *dilatatum* and less rank and erect than *larranagai* (Upright). The upright, as it is most commonly known, is more palatable than *dilatatum*. At certain periods of the year

it has been found that cattle will hardly touch the latter if the other grasses are available in the same paddock. This fact often accounts for its exceptional vigour.

Rhodes grass is worthy of mention: present experiments being conducted with this grass indicate that it is distinctly valuable on the semi-damp and drier edges of vleis, and where it does succeed, provides the most valuable grazing. Kikuyu grass unfortunately is more exacting in its requirements and is more at home on the rich heavy black vleis, but is best adapted to the eastern border districts.

Time to Sow and Rate of Seeding.—If weather conditions are favourable, seed may be sown towards the latter end of December and early January. Common sense is the best guide in this operation, and conditions which will favour good germination should be selected. Above all, grass seed is very small and should be covered lightly, and an ordinary harrow is too heavy for the purpose. Usually a fairly leafy branch of a tree drawn by hand across the land is fairly satisfactory, providing the land is as it should be, in a fine tilth and the surface is not sticky.

Swamp couch, like Kikuyu, is propagated by root division or runners if conditions are favourable. The former can be obtained from the Agricultural Experiment Station, Salisbury. This very useful grass is characterised and identified by its long stems, slightly flattened on both sides and most of the leaves and stem are reddish or dark purple in colour. Its common name, couch, is somewhat unfortunate and misleading, as neither its growth habit nor flower head is similar to the recognised couch or kweek grass. The flowering head is difficult to detect, being merely a closely jointed and sharp-pointed elongation of the stem. Planted 2 feet apart each way it should, in a few months, entirely cover the ground. *Paspalum scrobiculatum* should be seeded at the rate of 15 to 20 lbs. per acre and *dilatatum* and Rhodes grass at 10 lbs. per acre, *larranagai*, or Upright, at 5 lbs. per acre, to obtain a good stand from certified seed. It is advisable to mix the seed with fine dry sand to obtain an even distribution if sown by hand.

Chilled Beef, November and December Shipments.—The following extracts from cablegrams received from the High Commissioner's Office in London refer to shipments of chilled beef which arrived in England the week preceding the dates given.

2nd November.—Dunbar Castle consignment of chilled beef. Meat was of nice bright colour and dry, entirely free from mould or slime but a little too hard, and when cut showed distinct ice particles. Preparation very satisfactory and quality on the whole up to standard. Prices continue to decline owing to plentiful supplies of Home chilled meat. Average prices realised 4 7-16d. (hinds) and 2 11-16d. (fores) per lb.

Note.—This was a good average shipment comprising mostly Salisbury bullocks.

7th November.—Windsor Castle consignment of chilled beef. Beef discharged in very good chilled condition; clean, dry and bright with no mould or slime, and when cut no particles of ice were showing. Dressing very satisfactory, but taken as a whole standard Imperial beef not quite as high during the past few weeks. Average gross prices 4½d. and 2¾d. hinds and fores respectively.

Note.—On the whole this shipment was below the average.

16th November.—Warwick Castle consignment chilled beef. Dressing satisfactory condition, all quarters clean and dry, being free from slime and mould, but were in rather firm chilled condition. It was noticed, especially amongst hind-quarters, a heavy percentage quarters carried ice particles. Quality Imperial beef considered not quite up to the standard as received in the past. Quite a percentage lacked finish, particularly on loins. When beef was cut colour satisfactory, but Imperial Cold Storage would like to see more covering of fat. Average prices realised 4d. and 2 11-16d. per lb. hinds and fores respectively.

Note.—A good average shipment, though some of the cattle were rather aged.

22nd November.—Balmoral Castle consignment chilled beef. Dressing satisfactory, but split of loin, especially close to rump, not so well done as in past. In some instances practically little bone left one side, while fellow quarters had

more than their share. Condition very satisfactory, entirely free from slime and mould. Quality, generally speaking, satisfactory, and in some instances slight improvement over previous week. Percentage of Imperial beef very good, while some from aged cattle practically showed no gristles at the end of the chine bone fore ribs. Market easier, cheap, plentiful supplies, average prices 3 15-16d. hinds and 2 $\frac{3}{4}$ d. fores.

Note.—A good consignment. The majority of the bullocks came from Salisbury.

29th November.—Carnarvon Castle consignment chilled beef. Dressing generally satisfactory, being slight improvement on the previous shipment. Conditions very satisfactory, being clean, bright and of good colour without signs of slime or mould. Quality Imperial beef reached very satisfactory standard, slightly better than last few shipments, while ordinary beef in accordance with grade. Market continues dull and the prices averaged 3 $\frac{3}{4}$ d. (hinds) and 2 $\frac{3}{4}$ d. (fores).

Note.—A variable consignment containing a number of borderline carcasses.

10th December.—Edinburgh Castle consignment chilled beef. Dressing satisfactory, although in some instances butchers in opening ischiatic glands probed too deeply. Condition satisfactory, beef being nicely chilled, of a very good colour, showed very good texture when cut, entire shipment free from mould or slime. Quality particularly Imperial beef, very satisfactory. Shipment consisted of much younger cattle than received for some time. Market very depressed, average realised prices 3 9-16d. (hinds), 2 $\frac{3}{8}$ d. (fores).

Note.—Practically all the cattle were from the Shangani and De Beers ranches, Shangani.

13th December.—Winchester Castle consignment chilled beef. Dressing very satisfactory, coverings of beef excessively blood-stained, particularly throat, fore and wing ends of hinds. Considerable amount of drainage had taken place, and this understood in view of the fact that beef was exceptionally soft. No mould or slime and beef satisfactory; bright colour, soft throughout; in fact, fores on sloppy side would have been more satisfactory if firmer. Condition hinds generally satisfactory. Quality Imperial beef very good throughout and

most suitable product for retail butcher trade, being from reasonably young cattle ranging from $3\frac{1}{2}$ to 4 years, in some cases up to 5 years. When cut beef showed a nice texture in flesh. Ordinary beef usual satisfactory standard in accordance with grade. Market showed improvement and average prices realised $4\frac{1}{8}$ d. (hinds), 2 9-16d. (fores).

Note.—A consignment from nineteen different feeders. Small lots on the whole above the average.

The Rothamsted Report for 1933.—The appearance of the Rothamsted Report is an annual event of some importance to all interested in the technical advancement of farming. Agricultural advisers, teachers and students as well as the growing body of well informed farmers derive from its pages a considered statement of the results of the past year's experiments on plant nutrition and plant disease. For many readers the conclusions drawn from the experiments will suffice; but for the increasing number of technical readers who are interested in the development of field experimentation there is a section dealing with the design and presentation of the results of experiments and the use of tests of significance. For all the more important experiments and those showing new features of designs the plans and individual plot yields are set out in full. Summary tables follow and the appropriate standard errors are clearly indicated.

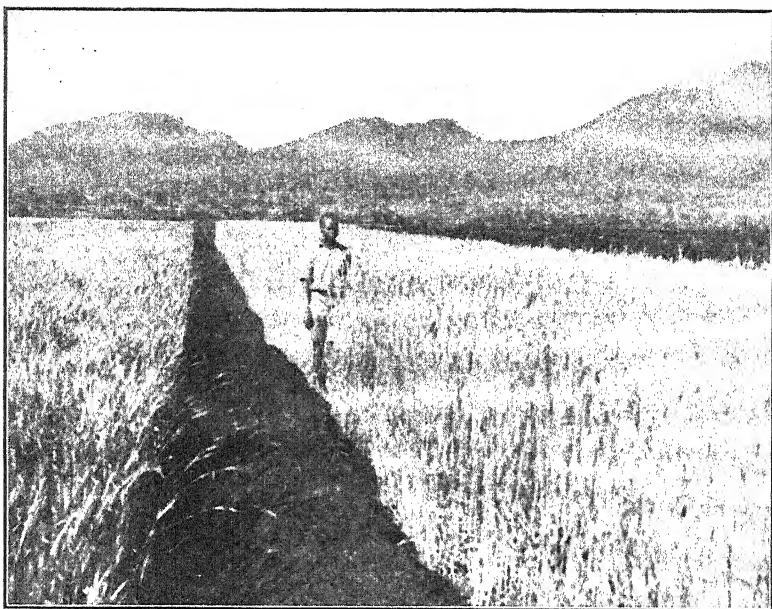
The report falls into two sections, one dealing with the field work on fertiliser and cultivation problems at Rothamsted, Woburn, and many outside centres in various parts of England; the other summarising the laboratory investigations whose details are to be found in the 52 scientific papers and 29 technical papers published in 1933.

In recent years uniform schemes of field experiments conducted at a number of centres have largely taken the place of the isolated trial, and in the present report will be found summaries of three series of this kind. One deals with the results of 10 years' experiments on malting barley, a second sets out the first year's results of an investigation of the fertilising value of poultry manure, the third deals with the effect of fertilisers on the yield and quality of sugar beet.

On the chemical side a comprehensive study is being made of the determination of manurial requirements of field soils by means of laboratory tests, using the now extensive body of accredited fertiliser experiments built up in recent years. A study of cultivation problems in the field is being made by the Staff of the Physical Department, an aspect in agriculture that becomes increasingly important as farm mechanisation proceeds. Two aspects of the question in particular are receiving attention. Rotary cultivation, being fundamentally different in its action from the traditional methods, is being studied in relation to the nature of the tilth produced and its effect on the germination and growth of the crop. Contrary to the common idea the tilth produced by rotary cultivation differs from an ordinary seed-bed, not so much in its fineness, but rather in its openness or fluffiness, as direct measurements in the field have shown. Another important series of experiments test intensive against normal cultivations, the latter being just sufficient to keep down weeds. Up to the present no definite benefit has resulted from the extra stirring of the soil. This point is important and is being followed up.

Work on virus diseases continues, and a detailed investigation of the causes in the fluctuation of insect population is now in progress. In the Insecticide Department important studies on Pyrethrum and other vegetable poisons are reported. The crops themselves can be produced in the tropical or temperate parts of the Empire.

In 1933 a beginning was made in the study of the technique of feeding experiments. An account is given of an experiment on pig management designed to test the possibility of applying to animal experiments the methods that have been so successful in modern field trials. Conclusive results were obtained, showing the necessity of green food for the growing pig, and the advantage of wet over dry feeding. The number of pigs run together in a pen had no appreciable effect on their performance.



Karachi (left). Rhodesian Reward Wheat (right).
Mazoe Citrus Estate 1934.

Rhodesian Reward Wheat.

Reward Ottawa wheat has now been grown in Southern Rhodesia during the past five seasons. It was originally brought from Canada by the Hon. L. Cripps and the seed was sown during the summer of 1929. Approximately 200 plants germinated, but the great majority were destroyed by rust. Two selections were made and these were the parents of the two strains which have been grown during the past four years.

The plant breeding work was transferred to the Government Farm, Marandellas, and the two strains, together with other varieties, were grown during the winter of 1930. The vlel on which the wheat plots were situated was extremely raw, and at reaping time only a small percentage of the varieties set seed, the two Reward strains being the most promising.

The work at Marandellas lasted one year only and the station was closed down late in 1930 owing to the general economic depression. The work was then transferred to the Tobacco Research Station, Salisbury, where it has been continued for the past three seasons.

Yield.—A fair amount of Reward seed has been bulked up on this station and it has also been used in variety trials with other well known wheats. Generally speaking up to the present the two strains have yielded as well as other well-known varieties on this station, but it will be obvious that work of this nature must be conducted over a number of seasons to obtain reliable results.

Protein Content.—The results of analysis for protein content of these two strains have been very satisfactory, averaging about 16 per cent. during the past three years, but it remains to be proved whether this wheat will maintain its high protein content when grown under other conditions.

Soil and seasonal factors undoubtedly play a great part in the *amount* of protein, but not necessarily the quality of the protein. Generally speaking the quality of the protein is

fairly constant. Under present circumstances it is not possible to determine this, but it is hoped that within the next year or so a sufficient quantity will be available to undertake a comprehensive baking test.

Rust Resistance.—Up to the present Reward has been very resistant to rust and showed up well during the past winter, which was an extremely bad one throughout the country in this direction. Several farmers to whom samples have been sent for trial have reported very favourably on it with regard to yield and rust resistance.

Ripening.—On an average Reward ripens at the same time as do Quality and Kenya Governor and ripens about two weeks earlier than Karachi.

General Characteristics.—Reward is a beardless wheat, has a fairly dense long narrow ear, white chaff, red plump grain and strong straw and grows about the same height as Kenya Governor.

Seed Distributed.—Samples of seed have been distributed to various farmers during the past two seasons, and 35 lbs. of each strain was sent to the B.S.A. Company's Citrus Estate at Mazoe for trial during the past winter. Karachi wheat was grown as a control. (See illustration.) Although sown lighter than it would have been normally, the yield can be considered satisfactory, producing over twelve bags per acre.

Generally speaking, reports from farmers to whom samples have been sent have been very satisfactory, but more data will have to be accumulated before any definite statements can be made in regard to yield, disease resistance and protein content when grown under ordinary field conditions.

It is considered desirable that a series of properly controlled fertiliser experiments should be undertaken to determine the most suitable dressing of fertiliser for any particular type of soil, and it is hoped to conduct such experiments during the next season.

The Show Standards of Cattle.

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NOTE.—*The following article is reprinted from the Journal of the Ministry of Agriculture, October, 1934.*—Editor, R.A.J.

Within recent years, there has been a good deal of discussion concerning the conformation of the dairy cow and its relation to milk production. There has been much dispute concerning the value of show type for commercial purposes. The showyard is being criticised. This has now led to questions concerning the value of our pedigree breeds of dairy cattle and it is stated that the methods employed by British stockbreeders in the past have been fundamentally unsound and that we are at the present day following a will-of-the-wisp policy of live-stock improvement. The culminating criticism is that, in view of either modern requirements or scientific advances, or both, we should scrap our present methods and breeds and start afresh our whole work of dairy cattle improvement.

To the majority of those who are connected with the dairy cattle industry, the final conclusions of these critics, as recently voiced, appear absurd. The present era, however, is one of new methods of viewpoints. However outrageous such criticism may appear, it behoves us to examine it from a double standpoint. Is it sound economically? Is it based on scientific fact?

Scientific Evidence.—Let us first deal with the scientific aspect. Much has been written concerning the inheritance of milk yield. Unfortunately the greater part of this work is based upon mere observation, as distinct from ascertained fact. The scientific investigations on this subject are not

numerous, but they are as many as could be expected, considering the rate of reproduction in the cow. The majority have been made in the United States.

From the evidence available the following facts are clear:

Total yield of milk is largely conditioned by heredity.

Nutrition and environmental factors are important and cannot be neglected.

Total yield of milk is inherited in no simple manner.

Quality of the milk is largely inherited, and is to a much lesser extent affected by nutrition and environmental factors.

The amount of fat secreted by a cow is, to a very large extent, inherited independently of the total yield of milk. As regards the other constituents, casein, sugar, hardness of curd, size and shape of the fat globule, and each of the principal minerals (except iodine), there is reason to believe that the same holds goods.

All these points are reasonably well proved, and, while nothing is ever certain, they can be taken as the basis for future work. Indeed, if the scientific method is worth anything, these facts must be used as the stepping-off place both for further scientific work and for practical stock improvement.

The inheritance of milk yield has long been recognised by practical stockbreeders to be a problem of great complexity, and it is therefore but natural that the breeder should look to the geneticist for some method whereby the workings of heredity might be accelerated—the more so as the life of the dairy cow is short when compared with the time taken to prove her milking capacity. The average life of a dairy cow is about six years. She is three years old before any general assessment can be made of her productive qualities, and is four years of age before this figure can be obtained with any degree of accuracy. Accordingly, the breeder has evolved a lore concerning the relation of the form of the dairy cow to her productive capacity, a lore that is also applied to the dairy bull. It is this lore that has become the foundation of our showyard system and that is now being so violently attacked.

As far as science is concerned this lore falls into two parts. The first relates to the points that are capable of scientific measurement, and the second to those that have so far defied accurate measurement. Of the measurable points of the dairy cow, certain definite correlations have been found between form and function. With a few exceptions the relationship is so small as to be barely worth further consideration from the practical aspect of stock improvement. Other things being equal, size, as measured by weight, bears a direct correlation to total yield. Thus it is that the progeny of certain bulls show an increased yield principally owing to the fact that their sire transmitted a big body rather than a big yield. Obviously, an Ayrshire cow will give more milk than the larger matron of the Scotch type of Shorthorn. Size is only an accessory factor towards increased production. To a lesser degree, certain measurements such as length, girth, etc., bear a similar relation to total yield of milk.

There is definite scientific evidence that conformation on the whole is no sound criterion of the true milking capacity of a cow. Especially as regards the shape of a heifer there is nothing measurable that can yet be considered to be of the slightest value as an indication of the amount of milk she will give when she calves. Indeed, scientific evidence points to the fact that it is definitely unsound to attempt to prognosticate the yield of a heifer either by measurement or by eye.

The other aspects of form—those that are not amenable to measurement—are probably of some importance, since they relate principally to the organs of milk secretion. One of these that has been scientifically examined, namely, the diameter of the milk wells, shows a definite correlation to productivity. It is, therefore, reasonable to assume that breeders, both past and present, are justified in taking into account the mammary development.

It has been shown, however, that the nature of the escutcheon (the area of skin between the hind legs stretching from the udder to tail head) is no indication of milking capacity. Where a positive correlation has been obtained between the shape of the escutcheon and yield of milk, this may be attributed to the fact that, owing to the escutcheon shape being hereditary, there has been in that particular

strain of cattle, a chance association of yield and escutcheon. This fact gives us a clue to one reason why so many breeders have associated form with production, particularly as regards points of conformation of no obvious utilitarian value. A breeder has a high-yielding cow with, let us say, a particular shape of ear. He remembers that the dam of this cow had both these qualities and notices that amongst the daughters of the son of this cow most of the high-yielders have also got ears of this particular shape. He therefore concludes that the ear shape is an indication of production, when the fact is that the association is more or less a chance one. It may, however, be of value to him in the selection of high-yielders of that particular strain. It also may not. If he finds that it is, the breeder tells his son of his observation. The son accepts it as gospel and it becomes incorporated in breed type. As generations of cows pass on, the association becomes weaker, but the belief is apt to become greater. This is where so many pedigree breeders have been led astray.

As the outcome of scientific observation it may be accepted that it is unwise to use conformation as a guide for the selection of cows with a high capacity for milk production, but this does not imply that conformation is without value. Unless a cow is capable of producing a minimum quantity of milk she is not a dairy cow no matter that she may belong to a dairy breed. Even if she does produce an adequate quantity of milk, she may still be unsuitable for commercial milk production. An adequate yield of milk as regards both quantity and quality is a pre-requisite, but there are other points of equal importance.

Amongst these points are characters that affect the length of life of the cow, and others that affect her economic utilisation of food or her powers to breed at regular intervals. If any of these characters can be shown to have any relation to conformation, then the principle of the method on which selection is at present based can be justified.

Take longevity first; it is the cow that produces 10,000 gallons in her lifetime that is more remunerative to her breeder than the cow that can produce 2,000 gallons in one lactation but cannot keep it up. We must recognise that in breeding for high production, we are selecting for a type of mammary

apparatus that puts a severe strain upon the other organs of the body. It is as though in the thoroughbred horse we were to select for ability to move at great speed but, at the same time, were to neglect the development of the heart. It is the thoroughbred that can win races throughout a long life that is remunerative to its non-betting owner.

The qualities that make for longevity are various and cannot all be described here. Amongst the most important are the legs and feet. Crooked hind legs, poor pasterns, and soft hooves are causes of serious loss in our dairy herds and are definitely of genetic origin. Because of undesirable hind legs, some high-yielding cows become absolutely worthless. If a cow has the right hind feet and legs, she can stand on concrete for fifteen to twenty years and she can travel to pasture without pain or trouble. It is very easy to get poor legs into a herd, and the only way to prevent this defect is to select breeding stock by conformation.

As well as being a possible measure of production, the shape of the udder is important from this point of view. There are good producers with capacious but otherwise badly-shaped udders: such udders are more subject to injury. Each quarter should be evenly developed and the udder should not be pendulous or cut up. The properly-built udder is protected from injury, is not so likely to be stepped upon and is much easier to keep clean. It is usually in the udder that cows show the first sign of unsoundness. Again, with the advent of the milking machine, the correct placing and size of the teats is a matter of great importance.

With regard to the economic utilisation of food, it is essential that a dairy cow should have plenty of capacity—both of chest and of digestion. A high producer may occasionally be flat in the rib, but it is seldom that she is an economic producer of milk when examined from the point of view of food consumption.

The saner objections to the show standards have centred around such descriptions as, “a clean cut feminine head with plenty of character and style, plenty of width between the eyes, etc., etc. Whether there is any correlation between these qualities and milking capacity has never been directly

scientifically determined. No one will dispute, however, that the appearance of the head of a cattle beast gives an indication of sex whether the animal be bull, steer or cow: but this indication is not infallible. There are cows with heads like steers. Likewise there exist effeminate bulls. If, in an animal of either sex the reproductive organs cease to function fully, then, in accordance with the degree to which the sex organs are upset, the appearance of the animal changes in the direction of an intermediate or neuter type, or may even approach the type of the opposite sex. Thus, the appearance of an animal is governed by the functioning of the sexual organs, which also govern both milk secretion and fertility. Hence it is not illogical to assume, as practical breeders have done, that there is a valuable connection between the head, as an indication of sex and the economic worth of a dairy cow.

To sum up the scientific evidence it may be stated that the existing method of the breeders, based on a correlation of form with function, is not unsound. While conformation of the dairy cow may give small indication of the capacity of the organs of milk secretion, it is of definite value as regards other qualities that are of prime importance from the standpoint of lifetime production.

The Economic Aspect.—Such being the scientific evidence the situation in England may now be examined from her rather peculiar economic standpoint. No other country in an advanced state of agriculture has so many cattle of the dual-purpose type. Some other countries wish they had, while others are content as they are, but that is not the present issue. The dual-purpose animal suits a certain type of farm economy prevalent in England. So far, no measure has been devised—or is likely to be devised in the immediate future—whereby the breeder may assess the value of the carcass of an animal on the hoof other than by the eye. Hence, conformation is fundamental in the selection of animals of the dual-purpose breeds.

“To every action there is an equal and opposite reaction.” It must be admitted that in every breed of live stock there has been a period when the principal breeders set undue store by some character whose economic worth was trifling. That some breeds diverged further than others from the economic

path is probably the reason for the present criticism, but does justify the conclusions at which the critics are arriving.

Our pedigree system is not at fault. Like other British institutions it requires some adjustment, especially at a time of economic stress such as at present. The same holds good as regards the show-ring. Yet let it be recognised that it is the pedigree system and the show-ring, together with the native wit of the stock raisers of England—and more latterly of Scotland—that have given the breeds evolved in these Islands, including the Channel Islands—the predominant position they now occupy in the agriculture of the world. There is only one breed of cattle of world-wide reputation that has not originated in the British Isles. For the future, as science devises measures of production and as it discovers more exactly the manner in which specific characters are inherited, so must these be incorporated into our methods of stock improvement and be grafted on to the art of breeding, just as we are now witnessing the incorporation of milk recording into the old methods of pedigree breeding and its grafting on to the ancient principle of the progeny test, so much used by the early breeders and for which the foundation is pedigree.

It is perhaps the show-ring that most requires adjustment to modern conditions. As Professor Scott Watson has said, the art of “bringing out” stock has made more progress than the art of breeding. More emphasis requires to be laid upon definite evidence of milking capacity before a cow can be entitled to the prefix “dairy.” There should be more place given to tests of families, daughters of one sire, etc. Also there should be a class for cows that have given over 10,000 gallons and for which every entry forwarded should receive a prize. When Shows were first started the educational aspect was first and foremost in the live-stock exhibits. Our show societies have not forgotten this, as witness the incorporation in their programmes of young farmers’ judging competitions, etc.; but they can advance still further.

Against the present system it is argued that the live stock of to-day are no better than the stock of a century and a half ago. That is not true. Undoubtedly there were at that period some high-producing cows, even after making allowance for the fact that milk was not weighed but measured by volume,

as delivered from the cow, complete with froth, and that it is difficult to determine whether the pints and quarts were Imperial or local. The point is that proportionately there were not so many high-producing cows as there are nowadays. Moreover, the average production of the dairy cow was not so high as it is at present. It is true that there are no figures to show the yield of the cow of 150 years ago; but there is no question that the yield has definitely improved during the past thirty years. Take only the figures of the officially milk-recorded cows. Annually these show a small but usually consistent increase. Since 1918, despite the fact that the number of recorded cows and heifers has been increased sevenfold, their average annual yield has gone up from 600 gallons to 700 gallons, *i.e.*, an increase of nearly 17 per cent. It may be argued that this is due to better methods of nutrition. That is in part the truth; but within the past few years the dairy farmer has had little incentive to feed for maximum production and to force his cows to the utmost. In addition, improvements in methods of nutrition can only be effective if the cows have the inherent capacity to respond to the increased feeding.

Here are recent figures of cows officially recorded in England, classified by breed, showing the numbers and the average yields of cows for the years ending October 1, 1929 and 1933 respectively. In studying the figures of the latter year it must be remembered that the price the farmer obtained for his milk was appreciably less than in the earlier year. The Index figure for milk for the year ending October 1, 1929, was 170, while that for the year ending October 1, 1933, was only 150.

Breed.	1928-1929.		1932-1933.	
	No. of Cows.	Average Yield. lbs.	No. of Cows.	Average Yield. lbs.
Ayrshire	1,430	7,334	2,172	7,236
Friesian	12,170	8,383	12,886	8,828
Guernsey	3,702	6,344	5,341	6,453
Jersey	2,512	6,250	3,123	6,307
Lincoln Red	1,561	7,123	1,085	7,248
Red Poll	3,000	7,017	3,723	7,176
Shorthorn	45,391	6,986	41,670	6,989
South Devon	1,000	6,747	1,076	6,420

It is also argued that since this annual improvement is so small we ought to scrap existing methods of improvement. Apart from the fact that such critics are unable to put anything in place of that which they decry, it can be questioned whether the rate of improvement is slow.

Looking at the question from a genetic aspect, the point is complicated. The speed at which the genetic improvement of any species takes place *should be measured in generations, not years*, and in relation to the number of genetic factors that affect the characteristic in question.

If it is desired to fix a breed whose only desirable qualifications are the absence of horns, a black skin and a white face, it would take at least six generations before these three qualities would be even approximately fixed, and even then off types would be produced in comparatively large numbers.

Milk yield is inherited in a far more complicated manner than is coat colour. If, after six generations of intelligent selection for coat colour, we are still apt to get off types, so shall we be apt to get, for a much longer period, cows of low milk production that must be culled from our herds. *The science of genetics offers no short cut towards the improvement of our live stock.* It justifies the methods of our master breeders, points to practices and beliefs that should be discarded, and by emphasis on the association of certain characters in their inheritance can certainly hasten the improvement of our stock. It cannot, however, substitute a quack medicine for the hard work and shrewd judgment that have characterised our master breeders of the past, and that will be as much required of their descendants in the future.

The science of genetics has already served a useful purpose in that our knowledge is being placed on a logical basis, whereby each new generation of breeders does not have to master the art from the beginning, but can make a start where its forerunners have ceased. As science codifies the laws of the inheritance of milk yield, so does it definitely assist the improvement of our average stock.

Tobacco Quota Commission: Report.

COMMITTEE OF ENQUIRY INTO APPLICATIONS FROM TOBACCO GROWERS FOR INCREASED PRODUCTION—SEASON 1934-35.

(Appointed by the Honourable the Minister of Agriculture and Lands).

Members.—William Brown, Esq., J.P. (Chairman), Government nominee; W. J. Atherstone, Esq., representing Rhodesia Tobacco Association; H. M. Barbour, Esq., representing Salisbury Chamber of Commerce (Tobacco Section).

Technical Advisers.—D. D. Brown, Esq., Chief Tobacco Officer; H. F. Ellis, Esq., Tobacco Officer.

Secretary.—L. C. Kernick, Esq.

The Honourable the Minister of Agriculture and Lands.

Acting on your request the Committee appointed by you to consider and advise on applications received from tobacco growers for increased production during the season 1934/35 has completed its task and submits the following report:—

WORK OF THE COMMITTEE.

The preliminary meeting of the Committee was held on the 1st November, 1934, when a deputation of the Rhodesia Tobacco Association was met. This deputation placed before your Committee their views on the principles to be adopted regarding the tobacco quotas to be allotted, and we desire to thank the deputation for the useful advice and suggestions which they put forward.

Thereafter your Committee met frequently in Salisbury, and owing to the full particulars which were put before them and to the help and advice of the Government Tobacco Advisers, it was not found necessary to call upon any applicant to give evidence in person.

In some four instances it was found necessary to refer to the applicants for further information. As no replies have been received to date from two of these applicants your Committee have consequently been unable to make any recommendations for these two cases.

Your Committee in many cases were handicapped in considering applications owing to the lack of information given by applicants. This might have been obviated had the Notice of Warning to Tobacco Growers in the *Government Gazette* been somewhat fuller and called upon growers to give more recent information in regard to barn accommodation and other matters.

APPLICATIONS FOR INCREASED QUOTAS.

Applications were received and dealt with from 167 growers who applied for quotas totalling 9,466,000 lbs., and after the most careful consideration your Committee recommended quotas amounting to 7,333,000 lbs. This shows an increase of 1,028,000 lbs. in excess of the applicants' yield for last season, or an average increase per grower making application of 6,155 lbs.

In many instances the quotas asked for by applicants were, in the opinion of your Committee, higher than they could reasonably expect to obtain, based on acreages, facilities and the average yield of the district; and it is quite possible that in some cases growers will not reach the quota that has been recommended for them.

As will be seen in a later paragraph, 670,000 lbs. of the above increased figure of 1,028,000 lbs. were accounted for by quotas allocated to new growers. Further, in running through the various returns your Committee has placed a finger on nine cases in which production due to adverse circumstances is very low in comparison with the average yield in the respective tobacco districts. Were your Committee to take the acreages planted by these nine growers last season and multiply such acreage by the averages for the various districts your Committee arrive at a figure of some 300,000 lbs. in excess of their actual yields.

In these cases, in treating them on their merits, your Committee has recommended quotas which amount to some 206,000 lbs. in excess of their last year's yields. This seemed

to your Committee to be only fair and equitable. It is mainly these cases and other similar ones with losses on a lesser scale, that have contributed to bring about the 378,000 lbs.—that part of the total increase resulting from your Committee's recommendations which remains after the deduction of 670,000 lbs. apportioned to new growers and to growers who did not produce last season.

NEW GROWERS.

Out of the number of 167 applicants, 28 were new growers, 27 of whom were allotted quotas on the basis of 20,000 lbs. of saleable leaf, and one 10,000 lbs.

Three former growers who did not produce last season were allocated between them 120,000 lbs., making a total of 670,000 lbs., which represents an additional figure of production for the season 1934/35.

Several applications have been received for quotas from individuals with many years of experience in growing tobacco, but mainly as managers or assistants to other people.

Your Committee in every case treated such applicants as new growers and granted quotas accordingly.

CLIMATIC CONDITIONS.

In considering the applications for increased production during this season your Committee gave serious consideration to the question of hardships which have been caused during the previous season owing to hail, wind, drought, disease and excessive rains. In many cases, owing to such outside influence, the yields per acre were very materially decreased below the general yield of the district concerned, and your Committee felt that it was only fair and just that such growers should be treated equitably.

DISTRICTS.

In order that the work of your Committee might be carried out along systematic lines all the applications were classified according to the eighteen electoral areas already recognised by the Rhodesia Tobacco Association. No applications were received from growers in Areas Nos. 7, 17 and 18. The following tables summarise the results of the deliberations of your Committee:—

Table I.

Area.	No. of applicants.	Quota applied for.	Yield last season.	Quota granted.	*Increase ‡decrease.
1	9	527,000	332,000	382,000	*50,000
2	33	2,020,000	1,559,000	1,685,000	*126,000
3	16	1,287,000	825,000	915,000	*90,000
4	5	319,000	170,000	240,000	*70,000
5	9	462,000	376,000	398,000	*22,000
6	1	25,000	14,000	25,000	*11,000
8	9	546,000	352,000	510,000	*158,000
9	7	549,000	419,000	310,000	‡129,000
10	15	642,000	384,000	515,000	*131,000
11	9	302,000	341,000	275,000	‡66,000
12	13	376,000	202,000	345,000	*143,000
13	6	256,000	151,000	230,000	*79,000
14	26	1,730,000	890,000	1,165,000	*275,000
15	2	40,000	—	40,000	*40,000
16	7	385,000	290,000	318,000	*28,000
Total	167	9,466,000	6,305,000	7,333,000	1,028,000

Average increase per grower : 6,155 lbs.

The following is an index of the numerical districts mentioned above :—

1. Lomagundi (Sinoia, Umboe, Eldorado).
2. Lomagundi (Banket, Trelawney, Darwendale).
3. Mazoe (East and West Umvukwes).
4. Mazoe (Concession, Glendale).
5. Mazoe (North Bindura, Darwin).
6. Mazoe (South Bindura, Poorti Valley).
8. Salisbury-Mazoe (South Mazoe, West Salisbury).
9. Salisbury (East Salisbury, Bromley).
10. Salisbury (Salisbury South, Beatrice).
11. Marandellas-Mrewa (North Marandellas and Mrewa)
12. Marandellas (Marandellas South).
13. Makoni (Headlands, Rusape).
14. Makoni (Umtali, Melsetter, Chipinga).
15. Hartley (Hartley, Gatooma).
16. Hartley (Norton, Lydiate).

Table II.

The following analysis classifies the growers on a production basis:—

Number of applicants	...	...	167
Held over or not granted...	...	...	8
Total considered	...	...	158

	Up to 20,000	21,000 to 39,000	40,000 to 59,000	60,000 to 99,000	100,000 and over.
Number	33	42	54	24	7
Percentage of total	20.3	26.2	33.8	15.1	4.5
Amount of increase	589,000	321,000	201,000	144,000	‡118,000
Percentage of total increase	51.1	28.6	17.9	12.9	‡10.5

Table III.

Estimated Crop Season 1934-35.

According to the figures of the Government Statistician the estimated weight of saleable leaf for the season 1933/34 was ...	24,000,000 lbs.
If we deduct the yield of the 167 growers who have made application to the Committee for quotas	6,305,000 lbs.
We obtain	17,695,000 lbs.
Again deducting from this the 20% mentioned in the Department of Agriculture and Lands notice in the <i>Government Gazette</i> dated the 14th September, 1934, gives a figure of	14,156,000 lbs.
Quotas recommended by the Committee for the season 1934/35 amount to...	7,333,000 lbs.
Which added to the latter figure would give an estimated total crop for the season 1934/35 of approximately	21,489,000 lbs.
This, in round figures, gives	21,500,000 lbs.
as against the Government Statistician's figures for the saleable crop for the season 1933/34 of	24,000,000 lbs.
A REDUCTION of approximately	2,500,000 lbs.

THANKS.

Your Committee desire to place on record their high appreciation of the excellent help and advice given by Mr. D. D. Brown and Mr. H. F. Ellis, the Government Tobacco Advisers, which has helped so very materially the consideration of each applicant. Your Committee also desire to place on record their thanks to Mr. L. C. Kernick in his capacity as Secretary for the splendid organisation which has likewise been of material assistance to the Committee, and also the various officials of the Agricultural Department.

Your Committee further desire to mention here their high appreciation of the work done and services rendered by the Government Statistician and his staff, without such detail it would have made the Committee's task a much more difficult one than it has been.

Salisbury, the 30th day of November, 1934.

(Sgd.) WM. BROWN, Chairman,	} Members of Committee.
(Sgd.) W. J. ATHERSTONE	
(Sgd.) H.M. BARBOUR,	

SUPPLEMENTARY REPORT (21.12.34).
FURTHER FINDINGS OF THE TOBACCO QUOTA
COMMITTEE.

At the request of the Acting Secretary, Department of Agriculture and Lands, a further meeting of your Committee was convened at 10 a.m., Wednesday, the 19th instant, in order to deliberate upon:—

- (a) Eleven new applications which were received after the closing date but which were supported by extenuating circumstances and, on the recommendation of the Acting Secretary, were submitted for consideration by your Committee.
- (b) Two applications which your Committee was unable to deal with during its last session owing to the inadequate information which was at that time placed before your Committee.
- (c) Eighteen appeals against quotas recommended by your Committee were referred for further consideration.

Appended are short remarks relative to the above.

(a) Applications were received and dealt with from eleven growers who last year produced 435,000 lbs. and now appealed for quotas totalling 755,000 lbs. After careful deliberation your Committee recommended quotas totalling 593,000 lbs., which shows an increase of 157,000 lbs. in excess of the applicants' yield for last season. Included are two new growers, to whom were allotted quotas totalling 35,000 lbs. The views of your Committee, as presented in the second paragraph of page 2 of the Final Report (applications for increased quotas), were reaffirmed in dealing with these late applications.

(b) Of these two applications one was ruled to be technically out of order when originally presented, but was subsequently rectified and dealt with. The reply furnishing further information from the other, as requested by your Committee on the 18th October last, is stated to have been misdirected, but on receipt of a copy of the missing letter the application was duly considered. These two growers applied for quotas totalling 173,000 lbs.; last year 87,000 lbs. was produced, the quota granted to them totalled 80,000 lbs., which shows a decrease of 7,000 lbs. under their production last year.

(c) Appeals from eighteen growers received the careful consideration of your Committee, and in only five cases was it decided that an increased quota should be recommended. The total increases recommended amount to 45,000 lbs. In each of the five cases the adjustment was effected only after the most careful analysis of further supporting claims which were not originally put forward by the applicants.

The attached tables summarises the further deliberations of your Committee.

Yours faithfully,
(Sgd.) WM. BROWN, *Chairman*,
Tobacco Quota Committee.

Table "A."

Area.	No. of applicants.	Quota applied for.	Yield last season.	Quota granted.	*Increase ‡decrease.
1	—	—	—	—	—
2	4	257,000	181,000	232,000	*51,000
3	1	100,000	70,000	75,000	*5,000
4	1	15,000	—	15,000	*15,000
5	—	—	—	—	—
6	—	—	—	—	—
8	—	—	—	—	—
9	1	80,000	44,000	68,000	*24,000
10	2	61,000	35,000	52,000	*17,000
11	—	—	—	—	—
12	1	152,000	36,000	95,000	*59,000
13	—	—	—	—	—
14	1	90,00	70,000	56,000	‡14,000
15	—	—	—	—	—
16	—	—	—	—	—
Grand total	11	755,000	436,000	593,000	*157,000

(Sgd.) W.B.

Table "B."

Area.	No. of applicants.	Quota applied for.	Yield last season.	Quota granted.	*Increase ‡decrease.
9	1	99,000	87,000	60,000	‡27,000
14	1	74,000	—	20,000	*20,000
Total	2	173,000	87,000	80,000	‡7,000

(Sgd.) W.B.

Table "C."

Area.	No. of appeals.	Quotas granted to applicants.	Revised quota.	Increase.
1	1	60,000	60,000	—
2	7	287,000	312,000	*25,000
3	1	30,000	40,000	*10,000
4	—	—	—	—
5	—	—	—	—
6	—	—	—	—
8	—	—	—	—
9	—	—	—	—
10	—	—	—	—
11	1	50,000	60,000	*10,000
12	1	Nil	Nil	Nil
13	—	—	—	—
14	5	50,000	50,000	—
15	—	—	—	—
16	2	115,000	115,000	—

(Sgd.) W.B.

THE WEATHER.

(Contributed by the Meteorological Office.)

The vagaries of the weather are inescapable and the answers to the questions: Will it rain Will it be cold or warm? Will it blow? How long will it remain fine or wet? etc., etc., are of interest to all and of vital importance to the farming community, aviators and seamen. It was the demand of the seamen which, at a time when the science was barely out of its swaddling clothes, saddled the devotees of Meteorology with the onerous task of supplying prognostications of the weather to all and sundry and incidentally supplied *Punch* with a butt rivalling the plumber in popular favour. From that time to this the official meteorological services have been struggling to keep up with ever-increasing demands. In spite of the progress which has been made in the last half-century and of the success of the forecasts issued by the leading services to-day, scientifically speaking little knowledge of the details of the processes which are at work to make or mar the forecast is in the hands of the forecaster when his decision is made. The forecaster has many unofficial and irresponsible rivals, but up to the present a study of rival methods, where such can be found, has thrown more light on the credulity of the public than on the problem of anticipating weather changes; official forecasts are based on ascertained physical laws applied to "Synoptic Charts," which represent as far as they are at present available, the relevant states of the weather over an extensive area at a fixed time; as the ascertainable facts leave large gaps in the forecaster's knowledge, it is necessary to make up by the exercise of the judgment which only comes with long experience and thorough familiarity with the groundwork of the science.

If full value and understanding of the forecasts is to be obtained it is necessary that the general principles of weather formation should be understood. This is fully realised in services such as the Navy, Mercantile Marine and Aviation in which courses in meteorology form part of the normal training.

GENERAL DESCRIPTION OF THE ATMOSPHERE.

The earth is surrounded by an atmosphere consisting largely of a uniform mixture of the gases oxygen and nitrogen with a varying admixture of water vapour; the atmosphere supports its own weight against the pull of gravity, and as the gases are highly compressible, its density falls off rapidly with height. The decrease of pressure with height is an exponential relationship which may be stated simply by disregarding minor variables in the form:—

$$Z = C \log \frac{p_1}{p_2}$$

where Z is the difference in height,
 p_1, p_2 are the two pressures

C is a factor covering relative humidity, gravity and temperature. Of these only the temperature need receive serious attention; a variation of the temperature of 3°C. (approx. 5°F.) alters the difference of pressure by 1%. Use is made of the barometric formula in graduating altimeters, these instruments actually work on pressure differences but are graduated to read heights; in calculating the graduations a constant average temperature is assured, in instruments indicating feet the standard temperature is taken as 50°F., and a correction of +1% must be applied to the indicated differences of height for every 5°F. that the temperature exceeds 50°F., if the temperature is below 50°F. the correction is subtracted.

Temperature varies with height in the atmosphere as well as pressure and the knowledge of this variation, which is called the "Lapse Rate," has increased very considerably with the introduction of the "Ballon Sonde," a small free balloon to which a very light recording instrument is attached, and more recently the "Radio Sonde," a similar instrument which radios the pressures and temperatures encountered. It is now known that the decrease of temperature with height is limited to a layer varying in depth from 17 kilometres (10 miles) at the Equator to 4 km. (2 miles) at the Poles, above this layer is a zone called the stratosphere, familiar to students of the daily Press, in which the temperature remains approximately constant with height, that is, has zero lapse rate; the vertical extent of the stratosphere is unknown.

in the surface layer, called the troposphere, the lapse rate of temperature in the first 2 or 3 km. (1 or 2 miles) is very variable, the temperature may actually increase with height, but, on the average, it decreases at the rate of 5°C. per km. (3°F. per 1,000 feet) and on hot days the lapse rate may reach 9 or 10°C. per km. The layer between 3 km. and 8 km. (2 to 5 miles) over Europe and extending to probably 14 km. (9 miles) over the Equator shows a constant lapse rate of 6 to 7°C. per km. (nearly 4°F. per 1,000 feet). The variable lapse rates near the surface are due to the heating and cooling of the surface layers by contact with the earth. The familiar diurnal variation of temperature disappears rapidly above the surface and is absent at levels above 1 km. The regular lapse rate in the upper air approximates very closely to that applicable to ascending saturated air and is probably maintained by this process. The surface of separation between the troposphere with its regular lapse rate and the stratosphere with zero lapse rate is called the tropopause, and its height is important as it marks the limit of the ordinary weather processes which require a positive lapse rate for their functioning. The normal zero lapse rate in the stratosphere precludes any but very slow vertical movements of air, and it is not known whether this zone takes any active part in the weather processes.

THE PHYSICAL PROPERTIES OF AIR AND WATER VAPOUR.

Dry Air.—Dry air is very nearly a perfect gas and its behaviour under given conditions can be calculated with precision.

The formula applicable to a perfect gas is:—

$$\frac{p}{v} = RT$$

where p and v are the pressure and density respectively.

R is a constant dependent on the gas and T is the absolute temperature.

(1) When it is compressed it gets hotter and when it is expanded it cools. The heating of a tyre pump and the cold blast which accompanies the reduction of pressure in a tyre are common examples of this fact.

(2) The weight of a volume of dry air depends on the pressure and temperature alone. In the atmosphere the pressure of two bodies of air in free contact must be the same and in consequence if one body is at a higher temperature than the other it must be lighter and, if free to move, will be displaced to a position above the colder air.

(3) In the troposphere both the temperature and the pressure decrease with height. If a sample of air at any height is displaced to a greater height the pressure will be less and it will expand and cool. Under normal circumstances the expansion will lead to a fall of temperature at the rate of 1°C. per 100 metres change of height ($5\frac{1}{2}^{\circ}\text{F.}$ per 1,000 feet), that is about 2°F. per 1,000 feet more than that in the normal atmosphere, the sample will then be cooler and therefore heavier than its surroundings and will sink until it reaches the level from which it was removed. The same argument applies to the case where the sample is displaced in the downward direction, and the following statement is generally true.

The atmosphere in its normal state is stable for dry air; if a sample is transferred from one level to another without change of heat it will, on release, return to the level from which it started.

Water.—Ice melts at 0°C. (32°F.) and water is formed; in the process unit mass of ice absorbs sufficient heat to raise the temperature of the resulting water 80°C. (144°F.). This heat disappears entirely (becomes "latent"), but reappears when the water freezes. It is called the latent heat of fusion.

Ice and water evaporate, giving off water vapour, in the process heat is again absorbed, in this case the amount varies, but may be taken as sufficient to heat an equivalent mass of water 536°C. (965°F.).

In all then water vapour contains, latent within it, a very large quantity of heat which may become available under appropriate conditions. This heat originates in the sun which pours radiation onto the earth continuously; the air is transparent to this radiation which passes through to the earth's surface where part is absorbed in warming the surface, part in evaporating water and part is reflected. Of the heat absorbed by the earth's surface, part goes to heating the lower

layers of the air by conduction, and the water vapour, with its store of latent heat, mixes with the air. The air, therefore, although it is unable to absorb the sun's radiation directly, receives a considerable proportion of the heat indirectly.

Water vapour has little resemblance to a perfect gas. In the presence of water or ice its pressure is dependent solely on the temperature and is unaffected by external pressure. If water alone, or water and air, are enclosed in a vessel the water will evaporate until the pressure of its vapour is that appropriate to the temperature. If the temperature is varied water will exaporate, or vapour condense, until readjustment has been achieved. The presence of air, apart from slowing down the process of adjustment, has no effect.

When the pressure of the vapour is the maximum appropriate to the temperature, the vapour, or loosely the air, is said to be saturated. The relative humidity in this case is 100%; should the air not be saturated the relative humidity is found by dividing the vapour pressure in the sample by the saturation vapour pressure for the temperature and expressing the result as a percentage. This is a very popular mode of indicating the degree of wetness of the air but is inconvenient for most purposes; alternatively the weight of vapour per unit volume may be determined, or the vapour pressure itself or an almost directly equivalent measure, the dew point. The latter has advantages when the humidity is to be considered in conjunction with the temperature. It represents the temperature to which the air must be reduced to obtain saturation, any cooling below this point will lead to the condensation of water and the release of latent heat.

The determination of the amount of water vapour in the air is of great importance. The most convenient instrument utilises the absorption of heat in evaporation. Two thermometers are necessary, the one called the dry bulb is simply used, as it is, to determine the temperature of the air, the other has a film of water on the bulb usually maintained by covering the bulb with thin wet muslin to which water is supplied through a piece of wick; should the air passing over the wet bulb be already saturated with water vapour, the bulb will not be affected and will record the same as the

dry, if the air is not saturated, evaporation will take place from the muslin and, as part of the heat absorbed in evaporating the water is obtained from the bulb of the thermometer, it will accordingly register a lower temperature. Empirical tables are available from which the amount of vapour present may be obtained when the reading of the dry bulb and the difference between the wet and dry are known. These tables may conveniently be presented in the form of a chart, an example of which will be reproduced in a subsequent article.

The weight of a cubic metre of saturated water vapour at various temperatures is shown below and also the proportion by weight of water vapour in saturated air at normal pressure and the same temperatures.

Temperature °F	— 4	14	32	50	68	86
°C	—20	—10	0	10	20	30
Water vapour,						
grams/cu.m.	0.89	2.16	4.85	9.40	17.30	30.37
Per cent. W.V./Air...	0.06	0.16	0.37	0.75	1.44	2.60

A Mixture of Air and Water Vapour.—Air in contact with water will gradually become saturated with water vapour. The amount, as the preceding table shows, is very small at ordinary temperatures. The rapidity with which the amount increases with increasing temperature is also clear from the table. Although the amount is small its latent heat makes it of supreme importance in weather processes. The heat released in condensing unit weight of water vapour is sufficient to raise the temperature of 2,200 times its weight of air 1°C. (4,200 times 1°F.). The freezing of water is not quite of the same importance, but even this releases sufficient heat to raise the temperature of 330 times its weight of air 1°C.

Water vapour entering the air from a free water surface will gradually diffuse through the air until it is all saturated, but the process of diffusion is very slow and plays a small part in atmospheric phenomena. In practice the distribution is accomplished by a process described in the next paragraph.

A mixture of air and water vapour, provided saturation point is not reached, behaves in practically the same way as dry air, and vertical motion is severely restricted; but should condensation occur the release of latent heat materially

affects the subsequent happenings. While dry air expanding as it rises through the atmosphere cools at the rate of 1°C . per 100 metres (5.5°F . per 1,000 feet) saturated air is supplied with heat from the condensing water vapour and its rate of cooling is reduced to approximately half, 0.45°C . per 100 metres at 20°C . (2.5°F . per 1,000 feet at 68°F .) this rate approximates to that pertaining to the lower layers of the atmosphere, and if a part of the air is heated more than the rest owing to some unequality of the surface it will rise, and if the extra heat obtained is sufficient to raise it to condensation level without its cooling to the temperature of its surroundings, then the reduced rate of cooling due to condensation will enable it to rise indefinitely. If irregularities in the lapse of rate do not arrest its progress it will reach the tropopause, but will not be able to go any higher. It is in this way that the heat radiated by the sun is distributed throughout the lower atmosphere and, incidentally, as a by-product, rain is distributed over the earth's surface.

METEOROLOGICAL CONDITIONS FOR THE FORMATION OF RAIN.

In the last section it was shown how, under favourable conditions, condensation of water vapour takes place in the air; cooling is essential to the process and the cooling is almost invariably the result of expansion due to vertical motion. It is within the range of possibility that two other processes may contribute to the condensation of water vapour. One is cooling by radiation and the second is cooling by mixing of air at different temperatures. The contribution of these two processes to the rainfall of the earth is probably very small compared to that of expansion and will be neglected.

Condensation takes place in the form of minute droplets on "Nuclei" present in the air; the rate of fall of these droplets is very small and they remain in the ascending air in the form of cloud; if condensation continues some of the drops will reach appreciable size and their rate of fall will increase until the rising air will no longer support them, the drops will then fall as rain.

Local Convection.—On a warm calm day, when the surface air contains a large amount of moisture, the unequal heating

at the surface will start a vertical circulation in the layers of air near the ground, patches of warm air will rise and be replaced by cooled air, condensation will take place in the ascending masses forming Cumulus cloud, which will grow to shower dimensions and, if conditions are sufficiently favourable, will develop into Cumulo-Nimbus with thunder and lightning and heavy showers of rain.

Consideration of this process will show that it cannot give widespread general rain. The total amount of moisture in the air over Southern Rhodesia on a hot humid day cannot exceed by much the equivalent of 3 inches of rain. Comparative calm is essential to the process so that supplies cannot be augmented from outside, and at best only a small portion of the water vapour can be removed from the air as a whole. The air in the centre of a shower is ascending at a considerable velocity, and as this air is being forced up by the pressure of descending cooler air which comes down slowly, the area of the descending currents must be much greater than that of the ascending and the area over which rain is falling at any moment is small. Thunderstorms of this type, though giving heavy precipitation over limited areas, can only affect a small part of the country and are capricious in their incidence. While conditions favourable for their occurrence are readily recognised, it is evident that it is quite impossible from the evidence conveyed on a chart to a scale of 1 inch to 60 miles to determine the places likely to be affected by random storms which may only affect an area of a few square miles.

Convection in Stratified Air.—Favourable conditions for the development of thunderstorms appear when the surface two or three thousand feet of air, which is warm and humid, is overrun by a solid current several thousand feet thick usually moving from a south-easterly direction. Violent thunderstorms of considerable extent may develop very rapidly under these conditions, and they have been known to travel long distances in the direction of the upper current. The rapid development of the storms is an indication that the upper current presents favourable lapse rates for convection, and it is possible, considering the direction from which the upper air has come, that it is relatively cold compared with the slowly moving surface air.

A condition somewhat analogous to this is described by Norwegian meteorologists; the slight disturbances due to the passage at a great altitude of an accluded front are said to precipitate the formation of a line of thunderstorms in air already approaching the shower stage, the storms follow the direction of the front, but at a slower rate, eventually being left behind and collapsing.

General Convection.—The cases of convection already dealt with are associated with the results of heating slowly moving or stationary surface air, under these conditions violent local falls of rain occur, but the total precipitation is limited to what can be wrung out of the air over the country. Widespread and long continued periods of rain occur when the country is invaded by winds from a direction between north and west, the sky remains more or less continuously overcast with alto-stratus cloud beneath which moves a broken layer of ragged, cumiliform cloud accompanied by intermittent cool driving rain. At times the upper cloud layer breaks and the increased radiation received below facilitates the rapid formation of cumulo nimbus cloud, which travels with the wind and from which heavy rain falls.

In the absence of soundings of the upper air any explanation of this type is purely tentative, but it appears that the invading air must be in a generally unstable state and that a fairly general ascent is taking place over a wide area. The ascending air is probably replaced by a convergence of the surface air from the sides. The disposal of the air at the top remains wrapt in clouds and mystery. Recent charts, of which examples may be given later, appear to indicate that the more intense rain in this type is associated with minor irregularities of pressure.

Orographic Rain.—When a mass of air containing sufficient moisture is forced to ascend a slope or cross a range of mountains, condensation will occur and very low cloud and drizzle result. The amount of precipitation due to this cause is not very considerable, but orographic features may lead to excessive rains at some places during general rain periods.

Fronts.—The meteorological world owes the development of the "Frontal Theory" of rain to the Norwegian meteorolo-

gists. Shaw and Lempfert studied the trajectories of surface air currents and published the results in a paper entitled "The Life History of Surface Air Currents" in 1906. In this work they came very near to the discovery, but it was left to the Norwegians to place an acceptable scheme before the world. The theory is simple in its essentials. Air moves over the earth in broad shallow streams composed of more or less homogeneous air, the characteristics of which are determined by the past history of the stream and are altered only slowly by the environment. These streams make contact with one another along "Fronts," the area of contact of the front is small in relation to the masses engaged and changes due to mixing have little effect on the general mass, the weather at the front is determined by the physical characteristics of the two air masses. The principal front, called the "Polar Front," is a tortuous and in places ill defined line encircling the earth in the temperate zone; it forms the dividing line between "Polar Air" originating in the Polar regions which has acquired an east to west velocity in its journey towards the Equator, and "Tropical Air," originating in the tropics which has acquired a west to east velocity in its journey towards the Pole. In general the two masses do not mix, the surface of contact lies at a slope of 1 in 100 to the horizontal, the warm air lying on top. Periodical disturbances occur along this front giving birth to families of "Cyclones," each of which has initially a "Warm Sector" and a "Cold Sector." On the surface the warm sector, which lies on the Equatorial side and forms a tongue intruding into the cold air, continually overtakes and rises over the cold air in advance, the sloping surface along which this rise takes place being called the "Warm Front," cold air curves round behind the warm and forces it up along a surface which is called the "Cold Front." The warm air is renewed by accessions from the open tropical side and, so long as this continues, the cyclone may deepen and intensify; eventually the cold front overtakes the warm front and the warm sector ceases to have any contact with the surface and the supply of warm air is cut off, from this time the cyclone is in a state of decay and gradually fills up and disappears. In practice the theory has been much elaborated, the original Polar and tropical air have been reinforced by "Maritime Polar Air," "Continental

Polar Air'' and others and a number of fronts of different constitution now receive recognition. It is also recognised that fronts in the upper air which have lost all connection with the ground may have an important influence on the weather, they are called "Occluded Fronts."

The whole of the theory in all its details has not received general acceptance, but the main principles, the general occurrence of extensive homogenous airmasses which travel long distances and of the interaction of these masses along fronts have been accepted and there is little doubt that most of the weather, at least in the temperate latitudes, is explicable in terms of these masses and fronts.

In applying airmass and frontal analysis to Southern Rhodesian conditions the meteorology of Africa is not sufficiently developed to enable us to trace the airmasses to their sources, and up to the present only modified frontal phenomena have been detected; but there is little doubt that a rigid application of airmass principles offers a solution to many of the difficulties. The principal airmasses invading this country are:—

(a) The north-westerly, which is cool and humid and is associated with much cloud and rain.

(b) The south-easterly, which is cold and humid; in itself this air gives some low cloud and drizzle of orographic type to parts of the country with a south-eastern aspect, the "Makasa," "Guti" and "Vumbi" being local names for the occurrence. Active fronts are formed when it meets air of different origin and steady rain may occur or a squall line of the cold front type may develop. The appearance of this air is usually the forerunner of a spell of fair weather.

(c) The easterly air, this is usually dry and is associated with periods of fine weather. It probably takes its origin in the high pressure on the east coast, with which it is associated. Easterly air of quite different characteristics is sometimes present.

(d) North-easterly air, containing a varying amount of moisture, is very prevalent over the northern part of the coun-

try; it is not in itself associated with much rain, but when invaded from the south-east by cold air a squall line is liable to develop.

The Movement of Air.—It is evident that the weather experienced is the result of changes taking place, in accordance with physical laws, in the air above us. If all relevant facts about this air at any one time were known it would be possible to calculate the weather for a few hours ahead. The amount of information required and the army of computers necessary to derive the results would be quite prohibitive, and it is likely that rule of thumb methods will hold sway for many years to come. It has been stated that the lower atmosphere consists to a large extent of masses of more or less homogeneous air which retain their characteristics over extended periods. The problem of forecasting would be solved could the movements of these air masses be correctly anticipated and their reactions with one another and with the changing environment be properly understood.

A partial answer to the second part of the problem is obtainable by a close study of the weather occurring in an approaching air mass, and if, as will be the case in time, a sufficient number of reliable vertical sections of the mass can be obtained by means of aircraft observations, radio sondes and, possibly other methods still to be discovered, this question will be in a fair way towards solution.

The solution to the problem of the movement of the air lies in the full application of the law of relationship between pressure gradient and wind velocity. The difficulties of the problem will be better realised if it is remembered that the working thickness of the air over Southern Rhodesia is probably 7 to 8 miles and that observations of upper wind indicate that normally two or three distinct streams of air are encountered in the first three or four miles, each probably having characteristics of its own.

Barometric Gradient and Wind Force.—Unfortunately the winds at the surface are markedly affected by local conditions and, together with surface temperatures and humidity, are not reliable indicators of conditions in the free air. The run of the upper winds is regularly observed at important

stations by means of "Pilot Balloons"; the method is reasonably accurate and cheap, but suffers from the limitation of cloud interference, which is usually at a maximum when conditions are most interesting. The method cannot be applied generally as it requires time and a technique not usually available at any but properly staffed stations.

An early discovery, the relationship between the pressure of the air and the weather, has provided us with the very misleading "Weather Glass" and a partial solution to the difficulty. The barometer consists of a glass tube in which the pressure of the air supports a column of mercury: as the pressure varies the mercury rises and falls and a scale is attached to the instrument for the accurate determination of the height of the mercury column. The pressure is determined in terms of the height of the column and was usually given in inches in English-speaking countries and in millimetres elsewhere. Recently agreement has been reached as to a unit and the millibar, a pressure unit, has been adopted. The standard atmosphere is approximately 1,000 mbs. and support a column of mercury 30 inches, or 760 mms. high.

When simultaneous readings of a number of barometers distributed over an area are suitably reduced to sea-level and plotted on a chart it is seen that pressure varies systematically from point to point; lines may be drawn joining points with the same pressure, called "isobars," and areas of low and high pressure called respectively "Highs" and "Lows," or "Cyclones" and "Anticyclones," appear together with troughs, wedges, etc. It was immediately discovered that the isobars are related to the weather, and study a succession of charts proved that systems of isobars, such as cyclones and anticyclones, persisted from day to day and travelled across the country, together with their associated weather. The earliest forecasts were based on these elementary discoveries. Buys Ballot, from a study of these charts, formulated a law connecting winds and isobars. "If you stand with your back to the wind in the Southern Hemisphere the pressure will be higher on your left hand side than on your right." The reverse is true for the Northern Hemisphere. The relationship between wind and the pressure gradient is, in fact, very close and is expressed in the formula:—

$$\frac{P}{v} = 2 w V \sin Z$$

where P is the pressure of the air,
 v the density of the air,
 w the angular velocity of rotation of the earth,
 Z the latitude.

Divested of mathematic symbols it may be stated: "In a steady stream of air the pressure field is arranged so that the gradient is at all points at right angles to the direction of motion of the stream, and the steepness of the gradient is directly proportional to the velocity of the stream and to the sine of the latitude." The direction of the pressure field is that given by Buys Ballot's law. If the wind trajectory is curved an additional term must be added to the relationship, the effect of this term is that air may curve to the right round a centre of low pressure with any degree of sharpness and that pressure gradients and wind velocities are unlimited. Curvative to the left round high pressure is limited by the latitude, and there is for all latitudes an upper limit to the possible pressure and wind velocity. The absence of limit to the curvature and velocity round low pressure is well illustrated in tornados, hurricanes and the homely dust devil.

This relationship between the movement of the air and the pressure gradient is mathematically rigid and, apart from the surface influences, is obeyed to a high degree of approximation in the temperate zone. The appearance of the sine term in the relationship is of major importance when dealing with the tropics. The sine of the latitude varies from 1 at the Pole to 0 at the Equator. From the Pole to 60° the change is small but its value is halved between 53° and 24° and again halved between 24° and 12°, the reduction in value in the sine term must be balanced by an increase in the velocity of the wind or the reduction of the pressure grade, in general the latter appears to be the case, and when Southern Rhodesia and England are compared the sine term shows that the equivalent wind velocity is three times as great in the former, whereas it is known that the wind velocities are lower; it is evident, therefore, that our pressure gradients must be more than proportionately reduced. This is undoubtedly the

case, and on this account pressure gradients must be determined with far greater accuracy in Southern Rhodesia than in England if the same standard of accuracy in relation to air movements is desired.

At the Equator itself where the sine of the latitude is 0 there can be no relationship between wind and pressure gradient. The indications of the formula would permit air movement but declare definitely against persistent pressure grades. The formula presupposes a steady state of motion in which the wind velocity is balanced against the pressure grade; it is evident that this cannot obtain at the Equator. The question of how far the formula is applicable in low latitudes is important, and it is hoped that the new B.E.A. Meteorological Service, whose activities extend across the line, will soon throw some light on the problem.

The isobar chart has played a predominant part in the history of meteorology, and it has been customary, implicitly, if not explicitly, to treat the pressure gradients as the origin of the winds. Margules has shown that the energy stored in the gradients is small compared with that of the velocity of the winds, and Sir Napier Shaw has, in his recent works, pointedly reversed the formulæ and writes as though he considers that the gradients are the result, not the origin, of the winds. It is fairly obvious that, considering the system as a whole, the energy is the sum of the two and in a closed system moving in latitudes, velocity will be converted or gradient or the reverse as the system recedes from or approaches the Equator. On this line of reasoning it would appear that the delicate adjustments of gradient to velocity could readily be made in an airmass approaching towards or receding from the Equator by a slight divergent movement down the gradient in the former and a convergent movement up the gradient in the latter; at the actual passage of the Equator the whole of the gradient energy would momentarily be converted to velocity preparatory to the reversal of gradient required by the change of hemispheres. If this is true then the law of pressure gradient and wind velocity is almost universally applicable and, apart from the difficulties incurred by the slight gradients, the paths of the airmasses should be traceable from the isobars to within a short distance of the Equator.

The determination of the true path of the air then hinges on the accuracy with which pressure distribution can be determined. The ordinary barometer is graduated to 0.1 mb., and individual readings by ordinary observers are likely to be within the error of 0.3 mb. Gross errors of 1, 2 up to 5 mb. are encountered, but are usually eliminated by inspection. It is possible to determine the level of the instrument within very close limits by precise levelling. In Southern Africa the altitudes of the barometers are obtained from railway surveys; the standard of accuracy of railway levelling is high, but over the enormous distances in Africa is subject to appreciable error. The error of closure at Salisbury between the levels from Beira and Port Elizabeth, a distance of nearly 2,000 miles, is of the order of 10 feet, and the levels of the numerous railways systems are not seldom based on datum levels which are not referred to sea level. After all ascertainable errors have been eliminated it is probable that appreciable variations remain. A difference of 10 feet is equivalent to 0.3 mb., and it would be unwise to rely on the levels closer than this.

Barometric readings, before they can be of any value on a chart, must be reduced to a standard level for comparison. The greater part of the African plateau lies several thousand feet above sea level and it would be manifestly absurd to adopt the conventional reduction to sea level. The system of plotting charts to a higher level was adopted in Southern Rhodesia several years ago and, after some trials it has been agreed between the B.E.A. Meteorological Service and Southern Rhodesia to standardise 1,200 dynamic metres as the level to which pressures should be reduced. Dynamic metres are more convenient than actual height and have the advantage of representing a "level" surface.

The pressure at this level is approximately 880 mbs. and pressures varying from over 1,000 mbs. to 800 mbs. must be reduced to this level as accurately as possible. For this purpose use is made of the barometric height formula discussed on page (2). Special tables are prepared for each station in which corrections for gravity and average humidity are included. The arguments of the tables are pressure and temperature. The accuracy of the reduction depends on the

temperature factor, an error of 3°C. (5°F.) affecting the result by 1% of the amount of the reduction. The temperature is that of a column of air between the station and the 1,200 dyn.m. level and can only be estimated from surface indications. In the case of sea level stations the reduction is of the order of 120 mbs. (from 1,000 to 880), and as temperatures are telegraphed to 1°C. there is an uncertainty of 0.2 mb. on this account. If the lapse rate of temperature varies from 2°C.—8°C. per kilometre errors of over 1 mb. may occur on either side of the mean. It is apparent then that pressures reduced from sea level are liable to serious error. The errors at inland stations can in one case be put to the test. There are three stations on the Eastern Border, Mount Nuza 2,032 m. (6,668 feet), Stapleford 1,617 m. (5,304 feet) and Umtali 1,119 m. (3,772 feet) very close together. The readings at Mount Nuza over a period of three months have been reduced to Stapleford and Umtali levels, using the method customary for the weather charts, the number of occasions where the reduced pressures differed from those actually recorded is tabulated below; where the stations immediately below one another, and the readings and reductions perfect, the differences would, of course, be nil.

Mount Nuza to	Average Pressure difference.	Number of errors by intervals of 0.1 mb.															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stapleford	40.5mb.	16	19	19	17	4	8	3	1	1	—	2	1	—	—	—	—
Umtali	90.9mb.	8	11	13	22	11	55	8	5	2	2	2	—	2	—	—	1

The standard deviation of difference in the first case is 0.35 mb. and in the second 0.48. Were the errors entirely due to reduction the Umtali errors should be more than double those of Stapleford; it appears probable therefore that about half the error in Stapleford is due to slight errors of observation and half to reduction. As a result of numerous trials it appears that no readily available combination of temperatures is superior to the air temperature at the time of reading 8.30 a.m. on the plateau but in general, for sea level stations the mean of the previous maximum and minimum temperatures is adopted, and for the West Coast, where peculiar temperature conditions exist special adjustments are made for each Station.

If the Mount Nuza-Stapleford reductions are taken as standard then the reduced readings from stations within 400 metres of the datum may be expected to be correct to within 0.5 mb. on the majority of occasions but to be quite unreliable when differences of 0.3 mb. or less are of importance.

At 20° latitude a difference of pressure of 2 mb. in 100 miles should be accompanied by a wind of 25 miles per hour, if the determination of the gradient is subject to errors of 0.5 mb. errors of 25% may be expected in calculated winds; with flatter gradients and light winds the errors will be proportionately greater. At 10° latitude the velocities are doubled and the results are likely to be very misleading.

The difficulty in regard to the assumed temperature lapse rate affects the value of the gradient wind determination in another way. The wind determination applies strictly to the layer at the level of the isobars only, and its extension to other altitudes is dependent on the presence of fairly uniform temperatures and lapse rates, the effect of differing mean temperatures is independent of latitude and, because of the weaker gradients in the tropics comparatively insignificant variations may lead to a complete reversal of gradients and winds in quite moderate heights. Solid currents, that is currents of air of fairly uniform velocity and direction of considerable depth, are comparatively rare over Southern Rhodesia and large variations and even complete reversals are the rule. It may be proved beyond reasonable doubt, in a given instance, that the air over the country has approached from the north, but this current may be overrun by a current from a quite different direction at a moderate height, and the resulting weather may be due either to the upper current alone or to the interaction of the two, and in neither case is the past weather likely to prove a satisfactory guide.

To sum up, in attempting to adapt isobaric charts to forecasting in the tropics the following difficulties may be anticipated:—Pressure system will be less well defined and subject to rapid modification. The absence of the Polar front will modify the weather associated with lows, and generally the relationship between isobaric systems and weather usual in the temperate zone will be modified in the tropics. In the zone between the prevailing westerlies of the temperate zone

and the easterlies of the tropics there is likely to exist a strip of variable wind currents where the movements of pressure systems may be expected to be irregular. The relationship between isobars and upper winds, however accurate the former may be, is likely to be of very limited application in the presence of horizontal temperature gradients.

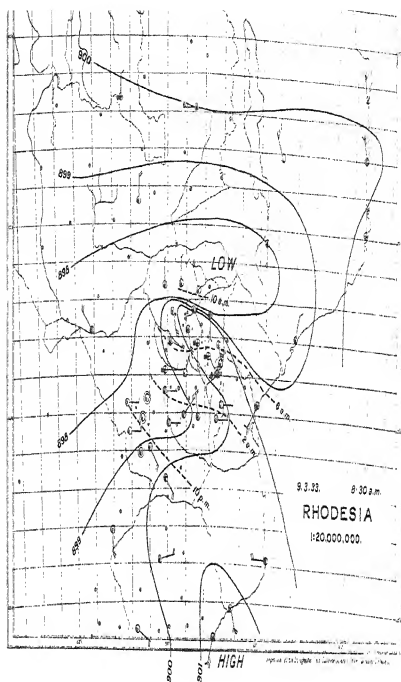
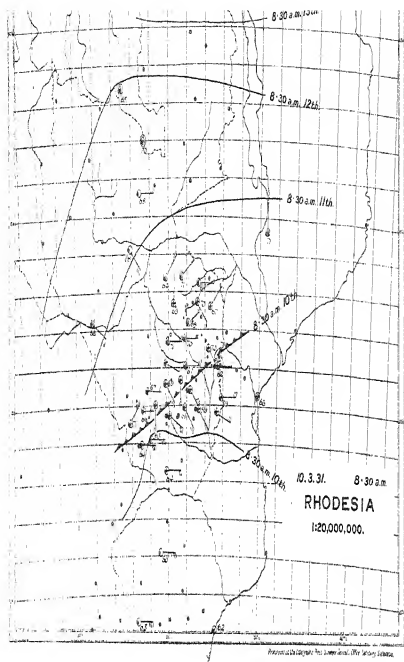
The relationship of weather types to the appearance of broad currents of air of different origin is likely to be more evident than in the temperate zone and the value of pressure system as such, unrelated to the accompanying air streams, is likely to be small.

THE WEATHER MAP.

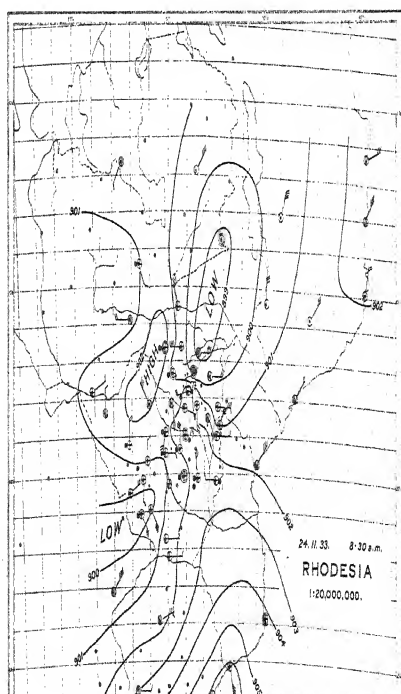
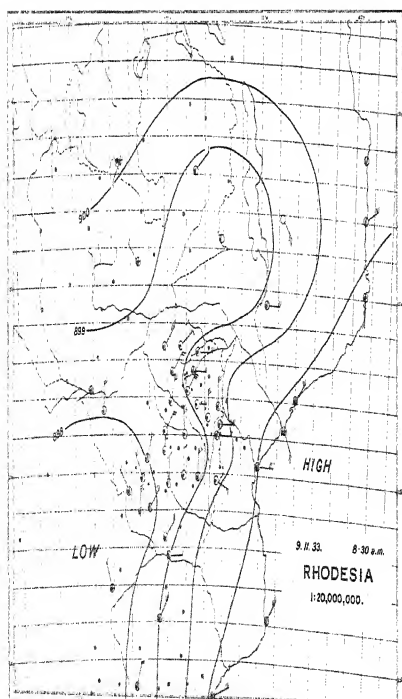
The synoptic chart of the meteorologist, commonly called the weather map, displays symbolically a great deal of information about the weather. A network of stations has been established over the whole of the inhabited world and standardised observations are made at more or less the same hours everywhere. The information required for the weather map is coded and despatched by telegraph to the central office and comprises detailed information of the kind, amount and height of cloud, visibility, weather at the time, direction and force of the wind, barometric pressure, air temperature, humidity, and rainfall all conveyed in a code report comprising six groups of five figures each.

On receipt at the central office the messages are decoded, plotted on the chart and examined for errors. Selected reports are distributed in group messages to other centres and are broadcast by radio at fixed hours. In England to-day a weather chart covering practically the whole of Europe and the East Atlantic is plotted every six hours and once a day practically the whole of the Northern Hemisphere is available.

The organisation in the Southern Hemisphere is nothing like as far advanced, the continents are sparsely inhabited and cannot afford the expenditure necessary to obtain even reasonably complete information for all the land areas and the vast tracts of ocean, seldom traversed by ships, make the production of complete charts an impossibility. In Southern Africa only one observation a day, at 8.30 a.m., is made; active weather services are in existence in the Union of South Africa, Southern Rhodesia, Portuguese East Africa, Madagascar and



ISOBARs at 1,000 dyn.m.



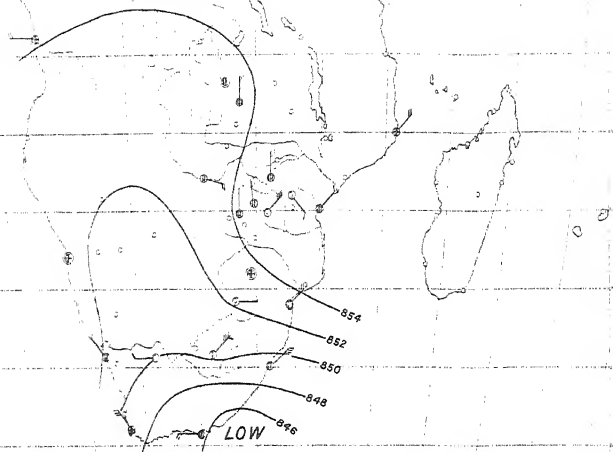
5.1.32.

8:30 a.m.

SOUTHERN AFRICA

1:50,000,000.

1,500 m.



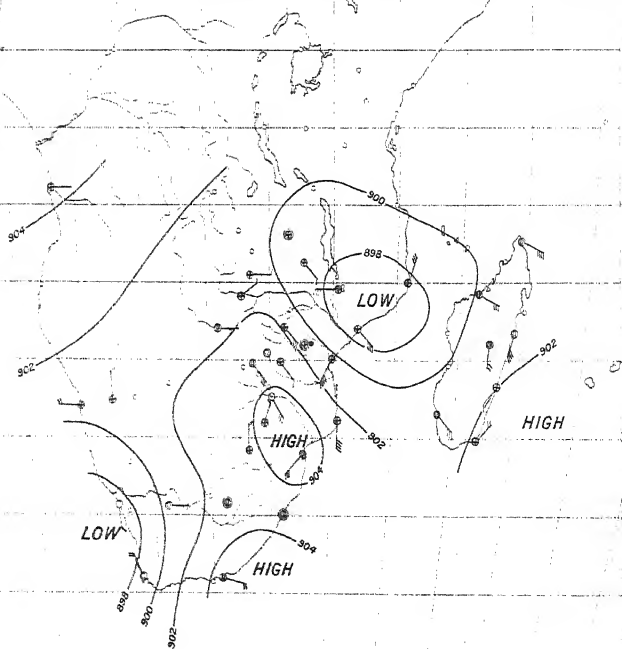
22 2 34.

8:30 a.m.

SOUTHERN AFRICA

1:50,000,000.

1,000 dyn.m.



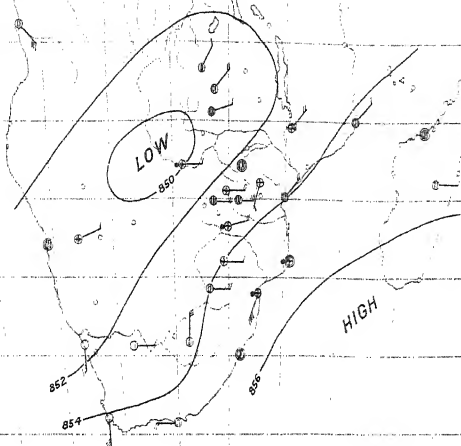
3. 3. 32.

8:30 a.m.

SOUTHERN AFRICA

1:50,000,000.

1,500 m.



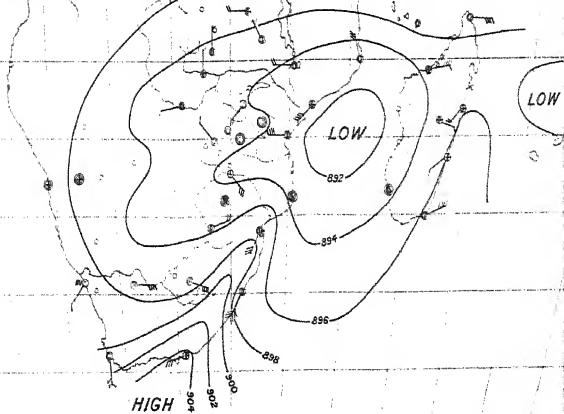
24. 2. 34.

8:30 a.m.

SOUTHERN AFRICA

1:50,000,000.

1,000 dyn.m.



Mauritius. And the newly formed B.E.A. Service, with headquarters at Nairobi, controlling Northern Rhodesia, Tanganyika, Kenya, Uganda and Zanzibar, is developing this area.

At Salisbury daily reports are received from the Union, Madagascar, Portuguese East Africa and Northern Rhodesia, in addition reports are received from single stations in Nyasaland, Belgian Congo, Angola, South-West Africa and from two in Bechuanaland. The collection of the reports takes time, and it is not often that the charts are complete before noon.

Four charts are plotted, examples of two of which are reproduced. The general weather map on a scale of 1:20,000,00 shows the pressure distribution, surface wind, cloud and temperature recorded over the whole area. The first plate shows two of these charts at 1,500 metres and two at 1,000 dyn.m., two of the levels which were tried before the present 1,200 dyn.m. was finally decided upon. Each Station is marked by a small circle hatched to indicate the amount of cloud, from a . to represent a trace up to four lines across and a + to indicate entirely overcast. The wind is indicated by arrows flying with the wind with the circle as the head, the number of feathers indicates the force of the wind on the "Beaufort" scale, four feathers indicating a wind of about 15 m.p.h. and eight a gale of over 40 m.p.h. The isobars, lines of equal pressure, are solid lines drawn for intervals of 2 mbs. and the numbers are whole millibars. Centres of high and low pressure are marked HIGH and LOW respectively. Temperatures indicated by figures have been omitted for clearness.

The second chart on a scale of 1:5,000,000 shows the pressure and weather in considerable detail over a limited area. It contains everything that appears on the first chart with, in addition, dew points and types of cloud, the rainfall of the day telegraphed the following morning is added in red. The charts of the 9th March and the 9th and 24th November illustrate current practice and introduce the two symbols, the black dot meaning rain at the time of observation and the T with a conventional lightning stroke indicating the occurrence of a thunderstorm at the time of observation. On the

chart of 10th March, which is not an ordinary weather map, and also that of the 9th March "Isochrones," or lines of equal time, are shown with the time indicated in figures. These are frequently used to indicate the travel of events. The black "scolloped" line on the chart of the 10th March is the symbol for a "Cold Front."

The third chart is similar to the first and shows the change of barometric pressure in 24 hours. It is called an "Isallobar" chart and is useful in indicating the travel of rising and falling pressure. The fourth chart has little to do with forecasting, on it are plotted the maximum, minimum and wet thermometer readings and also the difference from normal of pressure. It is used principally for checking and correcting errors of observation.

(To be continued.)

Locust Campaign.

OBLIGATION OF OWNERS OF LAND.

In view of anticipated heavy hatchings of locust hoppers throughout the Colony during the present wet season, the attention of all concerned is directed to the following sections of the Locust Destruction Ordinance, 1918:—

2. (1) Whenever locusts deposit their eggs or hoppers appear on any land, the occupier thereof shall, with reasonable speed, give notice thereof in writing or otherwise, to the nearest Magistrate or at the nearest Police Station.
- (2) In that notice he shall state as nearly as may be the locality where the eggs have been deposited or the hoppers have appeared, and such other particulars as may be prescribed by regulation.
4. Every occupier of land on which hoppers appear shall, in addition to carrying out the duty imposed upon him by section two, cause the hoppers to be immediately destroyed. Material for such destruction shall be provided free of charge by the Department; provided that such material shall be deemed to have been provided when delivered by the Department at the nearest Magistrate's or Native Commissioner's office or Police Station.
5. Any occupier of land who drives or causes to be driven or attempts to drive or knowingly permits the driving of hoppers from his land on to the land of his neighbour shall be guilty of an offence, unless he prove to the satisfaction of the Court that growing crops on his land were being threatened by the hoppers, and that in driving them away he took all possible steps to destroy them and did not drive them towards growing crops of his neighbour.
6. (1) If any occupier has failed to comply with the provisions of section two or section four, all expenses

incurred by the Department in destroying the hoppers may be recovered from that occupier in any competent Court, or any Court before which he is convicted may proceed without pleadings, but in his presence, to assess the amount of those expenses, and may give judgment for that amount with costs in favour of the Department, and that judgment may be executed in all respects as a judgment of a Court of Magistrate in a civil action is executed; provided that, if the occupier prove to the satisfaction of the Court that it was beyond his power to comply with the provisions of section four, he shall not be held liable for the said expenses and costs.

- (2) In the case of land on which there is no person resident as occupier, but which is not such land as is mentioned in sub-section (3) all such expenses shall be recoverable from the owner by action in any competent Court.

The following is the definition of "occupier" under the Ordinance:—

"Occupier" shall, in relation to land, mean the person having for the time being the legal right of occupation thereof, and shall include any agent of the occupier or any person in actual occupation of the land.

It is to be noted that any owner of land who has not surrendered the right of occupation thereof is responsible for the destruction of locust hoppers thereon.

Southern Rhodesia Veterinary Report.

OCTOBER, 1934.

AFRICAN COAST FEVER.

Charter District.—The mortality was 14 at the Greyling centre and 2 at the Riversdale centre.

FOOT AND MOUTH DISEASE.

No further developments occurred.

TRYPANOSOMIASIS.

Four cases occurred in the Melsetter district, two in Hartley district and two in Lomagundi district.

TUBERCULIN TEST.

Ten cattle were tested on importation with no reaction.

MALLEIN TEST.

Eighteen horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa:—Cows 10, bulls 3, horses 18, sheep 1,037, pigs 18.

EXPORTATIONS.

To the United Kingdom *via* Union Ports in cold storage:—Chilled: Beef quarters, 3,805. Frozen: Beef boned quarters, 1,871; veal boned quarters, 130; tongues, 4,425 lbs.; livers, 4,420 lbs.; hearts, 4,022 lbs.; tails, 3,339 lbs.; skirts, 923 lbs.; shanks, 6,913 lbs.; kidneys, 1,236 lbs.; glands, 792 lbs.

Meat products from Liebig's Factory:—Meat meal, 59,000 lbs.; meat extract, 1,058 lbs.; tallow, 26,726 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Schedule of Rainfall for Week ended 1st January, 1935.

	Total for week.	Total since Oct. 1st.	Normal to date.
Beitbridge ... ..	.95	4.69	5.82
Bulawayo... ..	.61	10.88	9.41
Essexvale	2.42	13.85	9.24
Fort Rixon	1.98	9.49	9.05
Gwanda ... ..	.24	5.56	7.81
Inyati	2.19	15.71	9.57
Matopos	1.49	9.11	9.37
Nyamandhlovu ... ..	.40	8.83	8.99
Bikita	3.68	22.82	8.96
Shabani	1.73	8.65	7.41
Fort Victoria... ..	1.46	10.23	9.68
Chipinga	3.38	17.18	13.68
Melsetter... ..	3.60	15.72	...
Enkeldoorn ... ..	.59	18.96	11.40
Gwelo	1.43	15.02	10.59
Hunters Road	1.61	13.92	11.44
Mtao ... ..	.68	14.06	11.13
Que Que ... ..	.95	15.43	9.99
Selukwe	1.54	25.13	13.59
Plumtree	1.10	5.37	9.15
Wankie ... ..	.71	13.57	7.95
Beatrice ... ..	.37	13.02	12.41
Gatooma	2.45	15.91	11.24
Hartley ... ..	.56	16.90	11.69
Makwiro ... ..	.60	14.59	12.83
Headlands	1.75	25.60	14.00
Inyanga ... ..	.62	23.47	12.25
Inyazura	1.15	14.27	12.04

	Total for week.	Total since Oct. 1st.	Normal to date.
Macheke	1.19	15.66	12.53
Marandellas	1.06	20.33	12.97
Mrewa ... ..	.60	10.11	8.41
Odzi	3.80	15.41	11.61
Rusape	1.33	15.72	8.55
Umtali... ..	1.73	16.61	10.46
Arcturus	3.00	21.85	13.14
Bindura	4.38	22.69	7.70
Concession	4.40	26.05	13.07
Glendale	3.51	21.49	11.47
Mazoe	4.33	21.20	10.78
Norton	1.68	11.28	13.94
Salisbury... ..	1.72	14.65	11.84
Shamva	4.00	20.28	11.53
Banket	3.26	16.21	10.78
Miami	1.00	15.65	8.71
Sinoia	2.38	18.66	11.26
Sipolilo	1.61	17.01	11.12
Mtoko	3.17	14.78	10.79
Victoria Falls ... ..	.61	9.29	9.82
Mount Darwin	3.02	...	...

Southern Rhodesia Weather Bureau.

NOVEMBER, 1934.

Pressure.—The mean pressure over the country was slightly below normal for the month, except in the south-east, where it was normal or above.

Temperature.—The mean temperature was appreciably below normal over the whole country.

Rainfall.—The rainfall from telegraphic reports for October shows approximately the average over the country; the distribution was very patchy, Matabeleland received very little and the south-east and eastern parts of Mashonaland were considerably over normal. The November rains were excellent and all areas received more than normal.

Rainfall in November, 1934, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	No me
1	...	97	10	1	...	...	...	...	...	...	...	5	1	11	5	1	46	88	17	43	89	35	7	...	...	...	...	...	...	...	456	26
2	...	19	24	2	...	...	...	...	...	...	...	13	23	...	...	...	31	27	93	76	29	26	207	5	10	...	11	2	...	...	598	26
3	...	1	4	17	...	...	...	...	...	...	...	18	...	53	6	1	...	45	7	102	141	72	135	38	4	...	30	1	27	7	709	44
4	...	40	63	1	...	...	...	...	...	...	...	8	34	21	1	6	67	89	94	63	9	16	175	9	7	...	1	...	...	...	704	34
5	...	50	17	...	...	...	...	...	...	...	...	1	...	15	20	1	41	23	20	...	65	21	18	...	...	...	...	...	...	1	293	24
6	...	2	17	...	5	...	...	...	...	...	...	3	36	...	11	63	15	93	42	28	5	28	42	19	21	...	...	...	2	4	436	35
7	25	6	...	...	...	...	...	...	...	...	62	35	14	4	22	32	35	34	48	24	57	99	59	3	2	47	12	17	637	42
8	6	7	6	...	...	...	...	...	...	...	54	...	7	18	71	4	23	99	47	78	54	91	7	19	15	22	2	31	661	36
9	2	4	20	...	...	...	...	...	...	...	50	1	13	12	18	25	76	111	28	11	6	102	3	8	9	50	...	12	561	31
10	1	...	...	...	...	...	...	...	...	67	13	41	1	30	40	37	104	26	105	73	132	21	45	2	...	...	10	748	32
Mean	...	32	18	2	3	...	...	...	...	...	...	4	28	11	11	11	35	51	47	53	45	30	63	37	12	4	3	12	2	5	519	30

SOUTHERN RHODESIA.

Locust Invasion, 1932-34.

Monthly Report No. 24. November, 1934.

During November Southern Rhodesia has suffered a phenomenally heavy and almost continuous invasion by great swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) coming from the north and north-west. In many instances these swarms have contained a considerable admixture of the Tropical Migratory Locust (*Locusta m. migratorioides*, Rich. and Frm.).

This invasion has been on a larger scale than anything yet experienced during the present swarm cycle. It would seem that the southward pre-breeding migration commenced north of the Zambesi, as there was no indication of any general southward movement previous to the arrival of the swarms from the north, some at least of which appear to have passed completely through the Colony into the Union of South Africa. Lack of southward migratory movement during the first part of the month is corroborated by information supplied by the Director of Locust Research at Pretoria, who reported that up to the 19th only two swarms had been reported as having crossed the Limpopo from Southern Rhodesia.

The northern stations reported incoming swarms moving south, south-east and east from about the 19th October, and by the beginning of November the full tide of the invasion had set in. The whole of the Colony is included in the invasion, but the movement over and through Matabeleland, when there were comparatively few swarms previously, has been phenomenal, thousands of square miles being reported as covered with the swarms. Travellers in one instance, report having driven through about 150 miles of locusts almost continuously, this distance being measured across the front of the movement. The depth of the movement from other reports was at least as great. This migration was passing

over Bulawayo and the railway line from Figtree to Gwelo for several days around the 10th November, the direction of the flight being S.E.

It may be stated that the speed of flight everywhere appears to have been slow but persistent. This was evident from the time which elapsed for the great swarms coming over the Zambesi to reach the occupied area included in the districts of Lomagundi, Mazoe, Salisbury, etc. The infestation of this area was comparatively light up to the third week of the month. Moreover, the vanguard of the great movement through Matabeleland had reached at least as far south as West Nicholson, in the Gwanda district, by the 10th, but as already stated had not been reported across the Limpopo by the 19th, although it has apparently crossed since that date.

At the end of the month every district in the Colony is reported to be heavily infested.

Tropical Migratory Locust.—Whilst no pure swarms of the Tropical Migratory Locust have been reported, it appears that it may have predominated in certain swarms. There are apparently considerably more locusts of this species in the Colony at present than at any time during the present cycle, and it appears that it has penetrated considerably further south than previously at this time of year.

In the Wankie district a correspondent estimates that 10 per cent. of the locusts present belong to this species. In the Urungwe (Lomagundi) district, the proportion is put at 50 per cent., whilst the Zambesi Valley is reported as "seething" with this species. Other districts where the Tropical Migratory Locust has been reported, in most cases confirmed by specimens forwarded to Salisbury, include Gutu, Chibi, Ndanga, Melsetter, Inyanga, Nyamandhlovu and Salisbury.

Egg-Laying.—Egg-laying was reported in certain districts as early as the 12th of the month, but the first definite record refers to the Lomagundi district on the 24th. By the end of the month several districts reported extensive egg-laying, particularly at low altitudes.

It is not possible to state definitely which species has been mainly concerned to date, but from examination of females at Salisbury it is probable that the Tropical Migratory Locust commenced ovipositing rather before the Red Locust. Egg-laying by the latter species was by no means general at the end of the month, most females showing only partial development, but during the last few days of the month some females with fully developed eggs were found, and specimens from one swarm from the Marandellas district indicated that the first packet of eggs must have been laid. Egg-laying by the Red Locust is likely to take place mostly during December. Hoppers of the Tropical Migratory Locust are expected early in the same month.

Damage.—Great damage to early grazing is reported from Matabeleland. In Mashonaland a number of farmers have reported destruction of young maize. There is ample time for re-planting, but winged swarms will almost certainly be very prevalent through December, and the outlook in the maize belt is decidedly menacing.

Enemies and Disease.—The White-bellied Stork (*Abdimia abdimii*) has been observed in considerable numbers attacking certain swarms of the Red Locust. The White Stork (*Ciconia alba*) has not as yet appeared, and has, in fact, been scarce in the Colony for several years past. No fungus nor bacterial disease has been found.

A dipterous parasite has been, and is, very prevalent, and is undoubtedly accounting for very large numbers of locusts. This parasite was recorded at the same time last year as attacking chiefly the fat bodies in the locusts, and in the case of the females, disturbing the ovaries. The muscular tissue was sometimes attacked. This year infestation seems to be mainly in the thorax, the maggots consuming the muscular tissue. The species has not yet been definitely identified even as far as the genus, although its identity is suspected. It is a small fly on the borderline between the Tachinidæ and Sarcophagidæ. The larva is usually reported by laymen as having a conspicuous black "head," the "head," however, being in reality a highly chitinized prolongation of the anal segment, bearing the posterior spiracles.

The capacity for destruction of this parasite appears to be very high. It is the only species so far met with this season, and has been recorded from all over the Colony, a high proportion of specimens submitted, in many instances, being infested. It is to be realised, of course, that parasitised locusts are likely to be more easily caught than healthy ones. The maggot-infested locusts have, however, been reported as falling in numbers from passing swarms, and in one locality the ground is reported as brown with the dead locusts.

It is a curious point that to date these parasites have only been found in *Nomadacris*. None have as yet been found in *Locusta*.

RUPERT W. JACK,
Chief Entomologist.

SOUTHERN RHODESIA Official Egg Laying Test, 1935.

The next test will commence March 1st, 1935. Entries close 18th January. Full particulars, rules and entry forms can be obtained on application to the Chief Poultry Officer, Department of Agriculture, Salisbury. Single pen accommodation is provided. Intending competitors are requested to make early application.

Farming Calendar.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant. or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses $1\frac{1}{2}$ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutabilis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and 'rotate' the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

FEBRUARY.

BEE-KEEPING.

In most part of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due. which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, *i.e.*, to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See *Rhodesia Agricultural Journal*, December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of goards. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gillias, larkspur, dianthus and pentstemon. The uower garden should be now looking its best, nearly all

plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and calitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mash instead of dry food, chopped onions and thick milk, are the chief reason for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially

in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any disagreeable flavour or colour, it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, $7\frac{1}{2}$ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

Departmental Bulletins.

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- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip.Agric.
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- No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
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- No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
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REPORTS ON CROP EXPERIMENTS.

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TOBACCO.

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THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

FEBRUARY, 1935.

[No.2

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Advice on Irrigation Matters.—Farmers requiring advice on soil conservation, irrigation or water conservation schemes, are requested to forward their names and full particulars of the work required to the Chief Engineer, Irrigation Division, P.O. Box 387, Salisbury, as soon as possible.

Applications should show the name of the farm, the type and the approximate amount of work to be done, and the month during which the visit is required.

The co-operation of farmers is requested in order to avoid as far as possible omissions of visits or delays of engineers on tour.

It is anticipated that the first tour will be arranged early in April.

Alcohol Motor Fuel in the Philippines.—In the Philippines mixtures of alcohol, gasoline and benzol and of absolute alcohol and gasoline have been tried, and found almost as satisfactory as straight gasoline; but the difference in retail price has not been sufficient to bring them into general use. In that country the cheapest and largest-used motor fuel is just 94.95 volume per cent. alcohol with only one per cent. of gasoline as denaturant, which simple formula has been permitted through the co-operation of the Bureau of Inland Revenue. The fuel sells for about 20 centavos (10 cents United States currency) per United States gallon, less than half the price of gasoline. At ordinary tropical temperatures it gives no trouble in starting. Some of the Centrals in the Philippine Islands with distilleries attached have found it profitable to discard old steam locomotives and replace them with internal combustion engines. For such purposes absolute alcohol has no particular advantage over the 94 per cent. spirit, since the latter is perfectly miscible when only small percentages of gasoline are required.—*Tropical Agriculture.*

Tobacco Quota: A Reassurance.—There appears to be a misconception as to the operation and intention of the Quota System in some districts. In the interest of those growers who are still uncertain of the underlying principles of the system a brief reassurance is therefore given.

Following the phenomenally good season last year the Rhodesian Tobacco Association, after a close analysis of the overseas market, considered that if the Rhodesian growers again were favoured with the good seasonal conditions which obtained last year, the market would be unable to absorb this country's production.

Through the media of both the Rhodesian Tobacco Association and the Press, warnings were given to growers, advising them to restrict their production to 80% of last year's crop.

It was made clear that in the event of this year's crop approaching the production level attained last year and if market requirements did not increase, then after consulting with the various interests concerned the terms of the warning

might be put into legal effect; that is, growers might be permitted to market only a percentage of their last year's production.

In certain cases, however, it was anticipated that growers who, through pests, drought, storm or hail, failed to reap the crop they might reasonably have expected, would suffer hardship in that it would be manifestly unfair to base the 80% restriction on a poor crop.

It has been observed that the impression seems to exist in some quarters that a quota to enable all growers to sell their leaf must be obtained, without which they will not be permitted to market their crop at all.

This impression is entirely erroneous. Only those growers who considered that their 1933/34 crop would be an unfair datum line upon which to base the 80% restriction need be at all concerned with the operations and findings of the Tobacco Quota Committee.

Chilled Beef: January Consignments.—The following extracts from cablegrams received from the High Commissioner's Office in London refer to shipments of chilled beef which arrived in England the weeks indicated by the dates given.

3rd January.—Arundel Castle consignment of chilled beef.—Beef in rather chilled firm condition, clean, dry and bright; no mould or slime seen. Dressing satisfactory. Quality not quite up to usual standard. Approximate amounts realised 4 1-16d. (hinds) and 2 3-16d. (fores).

Note.—This was the Christmas shipment. Imperial beef well finished but aged. Approximately half the cattle came from the Shangani Ranch.

4th January.—Kenilworth Castle consignment chilled beef.—Dressing generally satisfactory. Quality usual satisfactory standard. Condition very satisfactory, no mould or slime and a good colour. Very satisfactory beef and showing no ice particles when cut. Average prices realised were 5d. (hinds) and 2 11-16d. (fores) per lb.

Note.—A good shipment, but variable as regards age and finish.

10th January.—Windsor Castle consignment chilled beef.—Dressing generally satisfactory. Condition entirely satisfactory; quality not quite up to standard received recently. Very mixed parcel, market quiet and average price Imperial 4.36d. and 2.33d. Ordinary 4.34d. and 2.39d.

Note.—Poor shipment.

23rd January.—Balmoral Castle consignment chilled beef.—Dressing usual satisfactory standard. Shipment very mixed, there being some very good quality beef amongst Imperial grades. Condition rather firm, but with no mould or slime; when cut had a nice bright dry surface. Market quiet and prices realised were Imperial 4.55 and 2.85. Ordinary 4.33 and 2.72 pence.

Note.—Majority of these bullocks were fattened at the Cold Storage or the Devuli Ranch.

Migration of Birds.—Information Wanted.—A request was received recently from the German Bird Research Stations that all available information should be supplied concerning the movements or deaths of migratory birds in this Colony. At these stations large numbers of young birds are “ringed,” giving the name of the station at which this was done. A complete register is kept and an attempt is made to record the course of migrations, length of life, etc., of such birds. This request was sent to Colonel A. Essex Capell, C.B.E., D.S.O., who states that he will be pleased to supply information and also return any rings to the station concerned if he can enlist the assistance of farmers and others throughout the country. Any note of interest, or any ring taken from a dead bird should therefore be sent to Colonel Capell, Box 806, Salisbury

Storing Sweet Potatoes.—The following correspondence concerning the handling of sweet potatoes may be of general interest. A letter was received from Mr. J. A. Cumming, Eglington, P.O. Victoria Falls, as follows: “I note in your advertisement for sweet potato tubers for planting that you say they are lime treated to prevent rotting. Will you please

let me know the method of treating them as we have big losses with our sweet potatoes at this time of year due to them rotting in transit. Would the treated sweet potatoes be suitable for human consumption?"

The Agriculturist's reply read: "At the time sweet potatoes are lifted from the ground they contain a large proportion of moisture, and because of this, they are liable to be bruised during subsequently handling operations. For their successful transport it is important that the excess of moisture shall be allowed to escape before they are finally packed for despatch. This may be accomplished by allowing them to remain in the field, exposed to the drying action of sun and air for a few days immediately after lifting. Alternatively they could be loosely packed in shallow boxes similar to those employed in the overseas shipment of ordinary potatoes. The boxes could then be stacked in a suitable situation and in a manner which would allow of the free circulation of air among the tubers and thus effect the necessary reduction of their moisture content.

Lime Treatment.—Limewash of creamy consistency is prepared in a tank of convenient size. The potatoes are placed in wire netting baskets or perforated buckets and are then submerged in the wash, where they are agitated for a few seconds to ensure a thorough deposit of lime all over the skin of the potatoes.

The baskets are then withdrawn and placed to drain on a corrugated iron sheet previously erected in such a way that the surplus liquid will return to the tank. After drying for a few hours, the tubers are packed in boxes and despatched. The lime treatment does not render them unfit for human consumption to my knowledge. Washing and peeling before cooking would remove all traces."

Value of Ground Nuts.—In its latest published Survey—that on *Ground Nut Products* (H.M. Stationery Office, 4s. 0d. net), the Imperial Economic Committee continues its examination of world production and trade in Oilseeds and Vegetable Oils: two facts in the world trade stand out. The great increase—nearly threefold—in the world trade in this commodity as

compared with pre-war and the still greater increase in imports into Germany, which in 1929 and in 1930 were nearly ten times the quantities imported pre-war. India supplied the larger part of this increase in world trade. In 1933 two-thirds of the exports of ground nuts and ground nut oil originated within the British Empire, principally in India and in British West Africa. The chief foreign competitors are French West Africa and China.

The oil when refined ranks among the most generally useful of edible oils. It is one of the normal constituents of margarine, salad oils and salad creams. Only to a comparatively small extent is it used in the United Kingdom in soap manufacture. The residue, after extraction of oil, is valued as a cattle cake, and its use in the United Kingdom for that purpose has steadily increased.

World trade reached its peak in 1931, but declined very suddenly in 1932. Since then recovery has been taking place, and is apparently still continuing. The check to world trade has not, however, materially decreased production. In the year ending March, 1934, production of nuts in India was returned at over three million tons for the first time. Fortunately for world trade, stocks of ground nuts do not tend to accumulate over long periods. In all producing countries an elastic home demand exists which undoubtedly enables producers to meet rapid and marked changes in external demand.

Shipments of the nuts are made "in the shell" if the export market is relatively near. Otherwise, the heavier costs of transport are usually offset by shelling the nuts before shipment. The shipping of decorticated (*i.e.*, shelled) nuts effects a saving of about one-quarter in weight and as much as one-half in space. In the peak year, the producing areas shipped nearly 700,000 tons in the shell, over a million tons decorticated and oil equivalent to another 140,000 tons of shelled nuts.

France and Germany are the largest importers of ground nuts, taking together over 70 per cent. of the world imports in 1933. Except in 1928 and 1929, when Germany took the lead, France has always been the largest importer. Moreover these imports have steadily increased during the last ten years whilst quantities imported into Germany have fluctuated

violently. The next two chief importing countries—the United Kingdom and the Netherlands—together imported in 1933 less than Germany.

The Survey analyses the trades both in ground nut oil and in cake. In connection with the former it supplies interesting details of the quantities of different oils and fats used in the manufacture of margarine, compound lard and soap in the United Kingdom in each of the years from 1927 to 1933. The figures given illustrate the interchangeability of the various oils and fats. Prices of ground nuts and of ground nut oil are largely affected by the prevailing prices of other oils and fats. From the record of quarterly prices extending back to 1911, it appears that the lowest level was reached in March, 1934, since which date recovery has taken place. Yet in September, 1934, the wholesale price of ground nuts was less than two-thirds of those prevailing in September, 1911, 1912 and 1913. World prices of these oilseeds and vegetable oils have undoubtedly been adversely affected during the last two years by the restrictive measures on the output and consumption of margarine and lard substitutes introduced in several European countries with the object of raising the local prices of butter and lard.

Cattle Improvement and a Cattle Breeding Policy IN SOUTHERN RHODESIA.

A REVIEW OF THE GENERAL POSITION CHIEFLY
AS REGARDS RANCHING CATTLE.

By Dr. A. E. ROMYN, Chief Animal Husbandry Officer.

There has been much discussion recently in the Agricultural Press and at Farmers' meetings about cattle improvement and breeding policies, and a general review of the question from the standpoint of this Department should be of some value at this stage.

Factors which Influence a Choice of Policy.—A breeding policy cannot be settled until the general limiting factors of cattle improvement—the man, the farm, the value of market cattle—have been carefully weighed up and modified where practicable and necessary.

As things are at present more improvement could be effected by better management and the provision of supplementary feed, than by the use of better bulls or by the usual change of bulls advocated when the cattle are “not growing out as they should.” In many cases the use of better bulls would not be justified under existing conditions and any campaign of improvement must be preceded by a general campaign to spread information in regard to better cattle management and to assist in the culling out of undesirable stock. In these respects the Department is in a position to help farmers when called upon.

It must be emphasised that no one breeding policy can be laid down for the whole Colony. In the southern part of Rhodesia overstocking, for instance, has become a serious factor to contend with, especially in those areas where the provision of much supplementary feed is not an economic

proposition at the present time. In parts of Mashonaland, on the other hand, overstocking is not as yet a serious problem. In many cases indeed heavier controlled grazing would lead to definite improvement in the veld at this stage. Supplementary feed can, moreover, be produced at a reasonable cost and quite different breeding policies would be necessary to meet conditions in these two areas.

The problem in regard to beef and dairy breeds also needs different treatment. The greater return from dairying and the rapid deterioration of dairy cattle, if not properly fed, have lead to fairly wide use of supplementary feed. This makes it practicable to maintain stock of higher production than under ranching conditions. The dairy farmer is not therefore at the mercy of the "environment" to the same extent as the rancher, and his problem becomes the comparatively simpler economic one of first determining the most profitable level of production under existing conditions on the farm and then to feed and breed as far as possible to this predetermined level of production. There are satisfactory types of animals in the existing dairy breeds for this purpose.

The beef farmer under conditions where supplementary feed can be produced economically is in a similar position to the dairy farmer. By the use of good bulls of the existing beef breeds and proper methods of management it is possible for him to turn out as high grade bullocks as are required. The limiting factor in this case is the value of the cattle, as market prices recently have not warranted the use of sufficient feed to finish the cattle properly.

The most difficult problem concerns the rancher who, generally speaking, is keeping cattle to-day under conditions which cannot be improved economically to the standard which is necessary to maintain high grade animals. The problem is one of under-nutrition in its widest aspects. This under-nutrition most vitally affects the young stock. If provision could be made to mature the young stock fast enough to be ready for finishing as three-year-olds, there would be little complaint as to the quality of the beef produced, even with the present type of cattle. Generally speaking, if a beef steer is kept growing fast enough the type will tend to take care of itself.

To provide the feed and care necessary to overcome this under-nutrition is generally not an economic proposition under ranching conditions at present. Often the best that can be managed is to preserve the better grazing and water facilities for the weaners and to dose them suitably when internal parasites are prevalent. Where the carrying capacity is not too small and camps can be erected economically, paddocks should be provided for the weaners, which will do much better on their own than when herded. There is, unfortunately, a limit to the amount that can be done economically in this direction, and the rancher has therefore felt himself forced to look around for a type of beast suited to the market and one which will do well under such conditions as he can provide.

It is an open question whether a stable type to meet these requirements could be developed. While a satisfactory type might possibly be developed to-day, yet in the hands of the wrong people, or where overstocking is allowed to continue, progressive degeneration would simply set in again as the grazing deteriorated. The result would then be that smaller and slower maturing types of cattle would again appear with an ever-increasing recession from the market ideal. One would end with cattle little bigger than goats similar to those one sees now in parts of Africa and India.

Intelligent and conservative veld management is, in the long run, the most important factor in successful cattle raising under ranching conditions. I have no doubt that much of the loss of weight and quality apparent now in the ranching cattle, as compared with those of ten years ago, is due to overstocking and poor veld management. It is a great pity that more is not known about proper grazing control in this Colony.

The first cross of a European beef breed on native or Africander cattle is usually very successful; subsequent crosses are progressively less satisfactory and the amount of deterioration is often proportionate to the concentration of European blood. Under similar conditions Africander and native cattle do not deteriorate at the same rate.

Degeneration may be due to any one of a number of factors, such as the low value of the grazing, lack of water, mineral deficiencies, heat, internal parasites, tick borne

diseases, and lastly but not least, bad management. These factors may be summed up under the general term "environment."

By the provision of supplementary feed, proper control of the grazing and intelligent selection, the effects of these environmental factors can be largely modified. Conditions may even be improved to an extent sufficient to make the environment satisfactory for the raising of high grade cattle of the European breeds. The limit of improvement, however, is set by the value of the cattle sold and, under present market conditions, these returns do not justify a large capital outlay per head of stock in effecting improvements. Any permanent change in market conditions would naturally affect the amount that could be profitably spent in improvements.

The Place of the Africander.—In the present difficulty recourse has largely been made to the Africander breed.

The better type of this breed of cattle has now reached a comparatively improved level judged by conventional beef standards. It represents the nearest approach of an indigenous type in this country to the beef conformation desired. As a type, however, the Africander hump and length of leg are still serious disadvantages for export as chilled beef. The breed is hardy and fattens more readily under ranching conditions than the improved beef breeds. In many cases this extra condition more than off-sets the faults of beef conformation. Until recently little attention has been paid to the other indigenous breeds in South Africa. There is the possibility that as good or better results could be obtained from the use of the blood of some other indigenous type. The Africander at the moment, however, has a commanding lead.

The first cross of an imported beef breed with the Africander or with native cattle is, generally speaking, as satisfactory a type of beast as can be produced under existing ranch conditions. The ideal would be to find some satisfactory method of stabilising this cross with a fixed proportion of European and indigenous blood. In practice further top crosses with bulls of the imported breed result, as already stated, in progressive deterioration. Recourse to another imported beef breed in search of renewed hybrid vigour has, at the best, only been temporarily satisfactory, and some method has still to

be found to maintain the necessary infusion of indigenous blood without overdoing it, since too large a proportion of native blood is undesirable from a market standpoint.

The Methods of the Rancher.—A cross back to the Africander breed every second or third generation, or the use of grade beef bulls containing the desired admixture of Africander blood, are two of the commonest methods attempted to preserve the hardiness required.

1. *A cross back to the Africander.*—In practice this method has answered reasonably well. It has the serious disadvantage, however, that at recurrent intervals there generally arises an unmanageable surplus on the ranch of bulls of the breed which is being replaced. In some cases, co-operation between different ranchers in different stages of breeding up might help to avoid this surplus, the one requiring the larger number of Africander bulls exchanging with the other who might be increasing the number of bulls of the imported beef breed in his herd. As a rule, however, the surplus is difficult to dispose of profitably.

As an alternative to crossing back to the Africander, it has been suggested that two herds of cattle should be maintained—one, a herd of pure Africanders bred to Africander bulls for the production of female stock, and the other an ordinary breeding herd of Africander cows bred to bulls of an imported breed for the production of steers for market purposes. The cross bred progeny of both sexes from the market herd would be sold and the wastages in cows in the latter herd would be made good from the pure bred Africander herd. The method is not likely to find many adherents, however, unless there is a good sale for Africander oxen, as in practice too large an Africander breeding herd for the production of cows would have to be maintained in relation to the number of high grade beef steers produced.

A similar idea is sometimes advocated to divide the Colony into breed areas on lines similar to those followed in the distribution of the breeds of sheep in the United Kingdom. According to this plan the poorest areas would produce only Africander cattle and sell cows to ranchers in other areas suited for the raising of cross bred. The principle of the

scheme is sound, but the necessity for the wholesale annual purchase of cows by the ranchers raising cross bred steers is likely to be a serious disadvantage.

2. *Use of Grade Bulls.*—The use of grade bulls of an imported beef breed is fairly common.

Under existing conditions the practice cannot be entirely condemned either on economic or scientific grounds. A good type of grade bull will do less harm in a herd than a poor pure bred bull and a crop of calves is produced cheaply. In most cases, however, the use of grade bulls has been followed by deterioration and lack of uniformity in the progeny. Much of the deterioration is, however, undoubtedly due to the intensive overstocking of the veld which has been allowed to go on concurrently. The lack of uniformity is generally due to the casualness shown in the purchase or selection of grade bulls and the almost universal neglect of culling. There is something in the practice of using grade bulls if carefully controlled.

Other Breeding Plans.—These two methods represent the efforts of the practical rancher to meet his stockbreeding difficulties. Unfortunately, the necessary information has not been collected to take the matter much further, as far as this Colony at least is concerned, and a scientific survey of what is actually happening on the ranches is long overdue.

It is held, however, that permanent improvement might be achieved by:—

- (a) The development of a "Rhodesian" type of an imported beef breed which would thrive under our conditions.
- (b) The evolution of a new breed of cattle.

Both these systems would call for many years of skilled breeding to achieve final success.

1. *The Development of a Suitable Type of European Beef Breed.*—This plan represents the conventional road to improvement. A few herds of imported cattle have done very well in this Colony and, judging from ranching areas in other parts of the world where conditions superficially appear not so good as they are here, it is impossible to resist the

impression that by more careful selection of the female stock, especially where supplementary feeding at critical periods could be carried out, it should be possible to breed a type of high grade cattle of the European beef breeds with their more desirable market characteristics and maintain them on an economic basis. A few illustrations can be given where, by perseverance, and careful selection through the early years of acclimatisation, a satisfactory type of almost pure imported beef breed has been developed and is thriving in the Colony to-day. In most cases, however, where this has been tried the percentage of culling necessary has been too heavy to make this an economic method of breeding. In other cases the wastage in maintaining the original standard would have been too heavy to make it possible to maintain the strength of the breeding herd apart from any question of cost.

This straightforward method of improvement has the advantage that, if successful, improvement could be generally and immediately effected throughout the country on any farms where good bulls have been in use or are in use. It has, however, the disadvantage that the supply of bulls in the Colony necessary to maintain progress is very limited, and the loss of these bulls when introduced into the ranching areas from tick-borne diseases is generally heavy. It is seldom an economic proposition to breed bulls on the ranches to escape these dangers of acclimatisation, and the wider use of breeding stock of the imported breeds is not likely to obtain much support from the ranchers under present conditions.

2. *Development of New Breed.*—The development of a new breed combining the desirable qualities of both the indigenous and the imported beef breeds is not an impossible project. The history of the Santa Getrudis breed in Texas which has been obtained by crossing the Zebu and the Shorthorn is fairly well known from the accounts of Professor A. M. Bosman's recent visit to the United States which have appeared in the *Farmers' Weekly*. A similar breed, which would combine the qualities necessary under our conditions and breed true, might be evolved in this Colony from a cross of one of the imported beef breeds with the Africander, another indigenous breed or the Zebu, if necessary. The evolution of such a breed will, however, take time, skill and

money, and it seems too much to expect that an attempt to develop such a breed could be undertaken by private interests in this Colony under existing economic conditions, or that, if formed, it could be turned out in sufficient numbers to influence the general quality of the cattle produced for many years to come.

The alternative of attempting to breed a type of Africander more suited to the requirements of Smithfield seems a more practical proposition and might bring wider results. To do this the breed must be brought closer to the ground and the present tendency to breed for size must be discouraged.

Provisional Recommendations.—In the final analysis a breeding policy is determined by market returns.

When the value of the chilled and first quality beef improves, the demand for young cattle for feeding purposes will become stronger than it is to-day, and the ranching industry in this Colony may develop on intensive lines similar to the Western States of North America. Cattle would then be sold off the ranches as weaners or yearlings to be fed out by farmers who can produce the necessary feed cheaply. Under these conditions there will be greater demand for a high concentration of the blood of the European beef breeds than there is to-day. In the meantime, however, it is impossible to produce beef of the Smithfield quality in this Colony without a good deal of supplementary feeding. Cattle to produce the quality of chilled beef now exported from the Argentine must be kept continually on a fairly high plane of nutrition from birth to the day of slaughter. At present prices intensive beef production of this nature could hardly be made profitable under our conditions. A certain period of finishing has, however, been shown to be essential for the export trade, and the most economic beast for this purpose to-day appears to be the first cross ranch bullock finished at four to five years old. If properly finished this bullock has sold at $\frac{1}{2}$ d. to $\frac{3}{4}$ d. per lb. below Argentine beef.

Until a fixed and suitable breed of cattle is evolved, the most practicable plan to produce this type of bullock in the ranch areas appears to be to use bulls of an improved beef breed on Africander or improved native stock. When

deterioration and loss of constitution becomes evident, the progeny should be bred back to good type bulls of the Africander breed. These Africander bulls may have to be introduced every second or third generation, depending upon conditions.

The alternative at the moment is to use grade bulls. This practice is becoming more common. On the basis of the information available the practice in the hands of a skilled breeder appears to have a good deal to commend it. Care must be taken, however, that the bulls are not too "high grade." Instances are known where first cross and second cross bulls have been very successful, while $\frac{7}{8}$ th pure bred bulls of the same herds following them have been a failure.

Where only a few bulls are in service, ranchers are generally advised to avoid the use of grade bulls and to use either a good pure bred bull of an imported beef breed, or an Africander bull of good type when it is necessary to introduce indigenous blood. These pure bred bulls should have a known inheritance in contrast to the uncertain quantity represented by a homebred grade bull—often the progeny of an indifferent pure bred sire.

Where larger numbers of bulls are involved, it may pay at present to use grade bulls. Under present conditions they cannot be expected to bring progress, but if carefully selected, should prevent further deterioration in the stock until such time as a permanent breeding policy can be arrived at. It is reported that the use of grade bulls containing Zebu blood is common in the Gulf States of North America under similar conditions to Southern Rhodesia, and that it is the practice to avoid the use of grade bulls bred in the home herd and, where possible, to draw these bulls from a source distant from the ranch where they are required for service so as to secure the hybrid vigour which is expected to follow the use of a wide out-cross of blood and climate conditions.

In any case, before deciding to adopt either of these breeding policies, the first step should always be to improve ranch conditions to the limit possible so as to postpone the re-introduction of the indigenous blood.

Essential Investigations.—The breeding policies now tentatively recommended cannot be taken as a permanent solution

of the present breeding difficulties, even if the market continues to be stable on the present level. Ranchers are not likely to continue to buy bulls indefinitely of different breeds, neither of which is wholly satisfactory, and the grade bulls now produced are too uncertain in ancestry and breeding powers to effect any improvement in the ranching herds.

A successful cattle industry is of fundamental importance in this Colony, and the present policy of drift should not be allowed to continue. Many authorities consider that a ranch experimental station in the low veld of this Colony to study the cattle breeding problems of both Europeans and native producers in this and other parts of Africa should be of very great value and help materially to end the present uncertainty as to breeding policies.

At such a station a systematic effort would be made to develop a new breed with a fixed percentage of European and indigenous blood or an improved indigenous breed to suit the European rancher, and to evolve a breed of native cattle suited to the conditions of native husbandry in the reserves. The station would also act as a nucleus for general investigational work in cattle ranching and for the surveys of breeding practices in the ranch areas which are so necessary to get a clearer grasp of the whole problem. Fundamental problems in veld management and grazing control should be undertaken. Suitable bulls could also be bred for distribution in the ranching areas.

Such a station should be established soon in one of the territories in Southern Africa.

The work should be organised so that it can be carried on continuously for a period of years. The results will not come quickly, but data should be available before long to give the Ranching Industry some definite lead in the problems outlined and final results, if successful, would give this Colony a stable and profitable cattle industry.

Mycological Notes.

SEASONAL NOTES ON TOBACCO DISEASES.

8. THE MOSAIC MYSTERY.

9. DANGER POINTS IN FIELD SPRAYING.

By J. C. F. HOPKINS, D.Sc. (Lond.), A.I.C.T.A.,
Senior Plant Pathologist.

8. THE MOSAIC MYSTERY.

Once again mosaic disease is claiming the attention and imagination of tobacco growers. Its claim upon their attention is unfortunately not generally recognised until the crop is fairly well advanced and the disease has become widely distributed, but this does not appear in any way to hinder the exercise of imagination. The theories, counter-theories, dogmatic assertions and convictions regarding mosaic which are encountered in the course of a week's travel are sufficient to completely obscure from the grower the fundamental facts which are known about the disease. The precautions which are recommended by the Department of Agriculture (¹), and which have been proved to be successful on an extended scale, are simple enough for the methodical farmer, but these simple methods are in danger of being replaced by the most elaborate and wasteful operations, which have no effect in checking mosaic. It is only necessary to mention the spraying of wagons and boys with bordeaux mixture and the washing of oxen with disinfectant to illustrate to what stage of mental confusion the tobacco industry is being reduced! And why? Because a kind of folklore is being developed round the mosaic fetish which is gradually being converted into a mystery enshrouded in mystery.

It is true that scientists have not yet discovered the exact nature of a virus, but this does not mean that the behaviour of a virus disease is not understood. The mosaic disease of

tobacco has been the subject of much study for the last thirty years, and reasonable control methods have been practised in tobacco growing countries for the last ten years. Some five years ago a campaign against mosaic was started by the Department of Agriculture in this Colony, and the disease was almost eliminated in some districts as a result of the application of the recommendations which were made for control. These recommendations are well enough known by now and are aimed at the prevention of contamination of plants by infected sap. Infected sap may be contained in smoking tobacco, snuff and diseased growing plants, so that control of mosaic depends on the prevention of the transfer of plant juices from these sources to healthy plants. The obvious, and probably only, means of transfer is on the hands of labourers, and it is the duty of every grower to devise the best means of controlling indiscriminate handling of plants in both seed-beds and lands. The Department's recommendations provide for the exclusion of snuff and smoking tobacco from seed-bed sites and lands, regular washing of hands in disinfectant solution during the working periods, the rogueing out of mosaic plants as soon as they appear, and the employment of separate gangs of "boys" for handling healthy and diseased plants in the operations of priming, suckering, topping, insect collecting, etc. A further means of spreading the virus has been noted at the Tobacco Research Station, Trelawney, namely, the handling of plants by "boys" when they are applying a top-dressing of fertiliser.

Now, taking into account the mental make-up of the average farm labourer, surely it is possible by utilising these known facts to devise methods of field management which will reduce to negligible proportions the chances of mosaic disease being spread throughout a crop. It has been done in the past and is still being done by a large number of farmers in the Colony, so that it is up to the less successful ones to discover the faulty part of their routine which allows of infection being spread from plant to plant.

One important gap in the armour may be referred to. It is concerned with the incubation period of mosaic, that is the period which elapses from the time when the plant becomes contaminated with infected sap until the appearance of

disease symptoms in the young leaves. This period may vary from four or five days to as much as three weeks, depending mainly on the rate of growth of the plants. If the tobacco makes rapid growth after being set out in the lands, then it is safe to assume that all mosaic infected plants will be showing the usual mottling within two weeks, when the first priming of seed-beds leaves can be done with safety. If, on the other hand, the tobacco remains stationary and does not produce new leaves, then the appearance of mosaic mottling is usually delayed for as long as three weeks. Infected plants can sometimes be detected by the presence of the characteristic scorch or spotting of certain leaves, but the symptoms are not sufficiently distinct so as to be recognised by farm labourers (or even plant pathologists for that matter!), and there is a very real danger in priming off seed-bed leaves at an early stage.

If some disease such as angular spot or wildfire should happen to be present, then a decision has to be made as to whether priming will cause more loss by spreading mosaic than it will save by controlling the bacterial disease. In such cases as this, it is advisable to give one spraying with bordeaux mixture (°) as soon as the disease is detected and to do the first priming as soon as the plants have made sufficient growth for the presence of mosaic to be disclosed.

A study of local conditions during this year and last indicates that the rather alarming amount of mosaic to be found on some farms can be attributed to late appearance of the usual mottling as a result of poor growing weather early in the season. It has been observed on a good number of farms that seed-bed leaves showing frog eye spots had been removed before the plants commenced to grow out, and when normal growth took place an apparent sudden epidemic of mosaic occurred. Actually, the infection had been spread by the early priming of supposedly healthy, but really diseased, plants, and the apparently sudden outbreaks have been due to the mottling becoming readily noticeable when the crop commenced to fill out. It is hardly worth while mentioning that some sudden outbreaks of disease have resulted from continuous rainy weather—which has kept the farmer indoors for a couple of weeks!

In conclusion, it will not be amiss to explain once again the essential facts concerning mosaic.

1. Mosaic is highly infectious and is distributed throughout the whole of the sap of a disease plant, whether the mottling is to be seen or not.
2. Mosaic is not caused by rain, sun, heat, cold, new soil, old soil, bent tap root, incorrect fertiliser or government mismanagement, it is simply due to the presence of an infectious virus. **If the virus is absent, then mosaic does not occur.**
3. Mosaic mottling only shows up in growing leaves, particularly bud leaves and suckers, but nevertheless the whole plant is infected. The universal appearance of mosaic on suckers at the end of the season is the result of the constant handling to which the plants are subjected during topping and reaping.
4. All native tobacco and snuff is made from air-dried mosaic infected leaf collected at the end of the season. This material is the source of infection for the following year's crop.
5. The best control for mosaic in the lands is to pull out all infected plants before the first priming. A few gaps in the stand are better than a high percentage of infection later on. Remember, there are 5,000 or so plants to the acre, so that the removal of 100 per acre is only going to mean a reduction of 2 per cent. in the stand.
6. Another important field control is the thorough washing of labourers' hands with disinfectant at regular intervals. No more elaborate operation is necessary, but the plant gum and sap must be removed from the hands by washing—dipping is not sufficient.
7. **BORDEAUX MIXTURE DOES NOT CONTROL MOSAIC.**
—No kind of spraying is likely to have any effect on the spread of the disease despite what is implied in certain circulars which have been distributed

throughout the Colony. Bordeaux mixture does control bacterial and fungus diseases, and its use in seed-beds and lands is recommended for this purpose. It has never been suggested by this Department that bordeaux mixture has any effect whatever on mosaic, and any assertion to the contrary is unsupported by scientific investigation.

8. Finally, if, after taking precautions you still find mosaic in your crop, then you have been unlucky and infection has taken place despite your precautions. Such an event suggests that there is some weak point in your control operations; **not** that mosaic is due to something other than infected sap.
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9. **Danger Points in Field Spraying.**—In a previous article in this Journal (2), notes were given on the use of bordeaux spray against fungus and bacterial diseases in the lands. This season a considerable number of farmers have taken up field spraying, but in not a few cases instructions regarding the preparation and application of bordeaux mixture have not been correctly carried out. As a result, a certain amount of scorching of good leaf has taken place, so that it appears to be desirable to call attention to the absolute necessity of strict supervision of field operations.

Firstly, fresh water-slaked lime must be used in making up the spray fluid.

Secondly, the mixture must be made in accordance with instructions given in the Departmental handbook "Diseases of Tobacco in Southern Rhodesia" (1). The Concentrated solutions must not be mixed together and diluted later; the solutions must first be diluted and then mixed.

Thirdly, wooden barrels make the best container for copper spray solutions, but if iron drums are used, they must first of all be treated inside with some inert covering, such as a bitumen paint.

Fourthly, any liquid left over after spraying is completed must not be kept and used again.

Fifthly, if proprietary brands of bordeaux are preferred, care should be taken to see that they are in good condition.

If, when mixed, the spray fluid is not of the correct blue colour, or the suspended matter is granular and settles almost immediately, then the whole should be discarded. Several cases have been noted this season of more or less severe scorching resulting from the use of deteriorated bordeaux powder.

Sixthly, the plants should not be soaked with fluid. The nozzle should give a very fine, mist-like spray from a high pressure pump and should be held well above the plants so that the liquid settles gently on the leaves and forms a fine film. The spray should not run from the leaves at all.

Seventhly, do not spray large plants. The applications of bordeaux should be given before the final priming leaves have opened; that is within the first four or five weeks after transplanting, according to the rate of growth of the plant. If this is done correctly, there is little chance of a heavy infection of fungus or bacterial diseases occurring later.

It is important to note that buyers have stated they will not accept leaf showing spray deposit or blemish.

Field spraying requires to be carried out with much care and for the best results to be obtained it is absolutely essential that correct pumps, nozzles and spray material be used. Slipshod methods and cheap substitutes will inevitably bring trouble in their train.

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A Home-made Cow Stanchion.

By Major R. R. SHARP, Whinburn, Redbank.

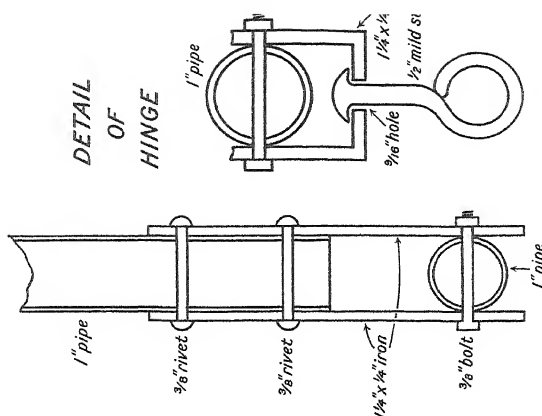
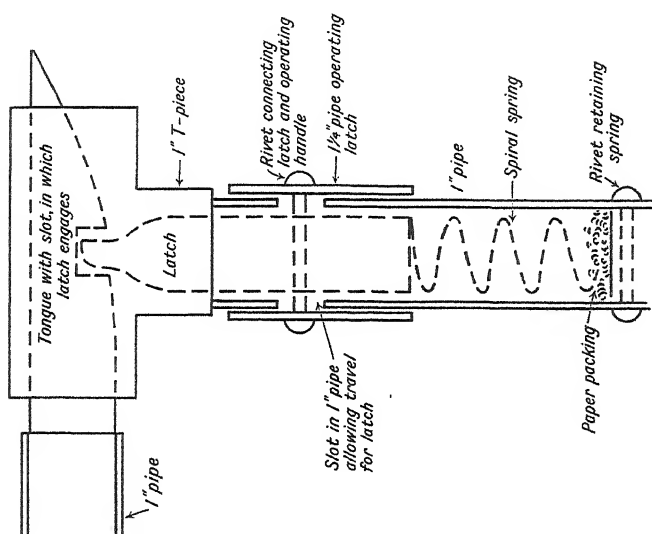
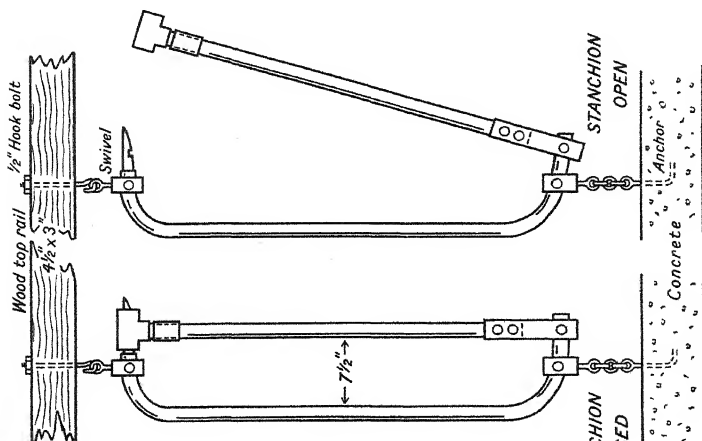
It is, I suppose, the ambition of most dairy farmers to equip their cow-byres with stanchions, but the cost of the purchased article is usually prohibitive.

The writer faced with this problem has recently devised a home-made stanchion, which can be turned out in the farm workshop at the cost of some five or six shillings. The stanchion, which is shown in the accompanying diagram, is made chiefly of 1 inch piping. Black piping is preferable, as it is easier to bend and screw; the difficulty of cracking the bends can be overcome if desired by bends or elbows; these, however, slightly increase the cost and, of course, weaken the structure at the points where the pipe is screwed.

The stanchion consists of two pieces of inch pipe hinged at the bottom. The longer piece is bent at each end and is suspended by a swivel joint from a heavy wooden rail running the length of the byre, 4 feet 6 inches or 5 feet above the floor, and attached at the bottom by another swivel and a few links of light chain to an anchor embedded in the concrete curb forming the front of the manger.

The difficulty in bending the pipes arises from the fact that very short bends have to be made and the pipe is liable to distortion in the process. This can be obviated to some extent by filling the pipe first with sand. The bend is then made in the fork of a tree or other convenient place without heating the metal. The necessary leverage can be obtained by inserting the end of the 1 inch pipe into a length of $1\frac{1}{4}$ inch pipe. The pipe is then gradually bent, moving it an inch or so at a time in order to distribute the bend over the whole of the available length. Finally, the sand, which has been well rammed into the pipe, can be shaken out.

The bent portion of the stanchion carries a tongue inserted in its end, which can be made of a short length of



DETAIL
OF
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$\frac{3}{4}$ inch steam pipe, forged to shape. This tongue has a recess to receive the latch when the apparatus is locked; this recess can be cut with a hack saw, and is about $\frac{3}{8}$ inch wide and $\frac{3}{8}$ inch deep. The latch itself is made of a short length of heavy $\frac{1}{2}$ inch pipe flattened at one end and filed up to present a smooth surface to engage with the tongue. It is held up to its work by a spiral spring contained in the vertical 1 inch pipe, and is operated by a sleeve of $1\frac{1}{4}$ or $1\frac{1}{2}$ inch piping, which must be free to move easily outside the 1 inch pipe. Sleeve and latch are connected by a $\frac{1}{4}$ inch rivet passing through both. The necessary travel is given by cutting a slot longitudinally in each side of the 1 inch pipe. Thus when the outer sleeve is grasped and pulled downwards, the spring is compressed and the latch withdrawn, allowing the tongue to be withdrawn from the 1 inch T in which it is enclosed in the locked position. The ordinary 1 inch T pipe fitting is screwed on to the top of the straight or swinging arm of the stanchion and gives rigidity to the whole when locked.

The main hinge is made of two pieces of $1\frac{1}{4} \times \frac{1}{4}$ flat iron rivetted to the straight pipe and the pivot is a straight $\frac{3}{8}$ bolt passing through both pieces and also the end of the curved pipe. The swivels are made of short pieces of $1\frac{1}{4} \times \frac{1}{4}$ inch iron bent into a U shape and drilled to take attachments of $\frac{1}{2}$ inch mild steel, which form the top and bottom fastenings.

The spiral springs should be fairly light; old Ford valve springs are excellent. The rivet which holds up the spring at the bottom should be placed about $\frac{1}{2}$ inch too low. Packing of paper can then be placed above it and rammed down, until the spring has the required tension.

The stanchion can be made by anybody with the help of ordinary farm tools, drill, forge, vice, etc.

The first six which I made have been in use for over six months and have given complete satisfaction. It is thought that other farmers may be interested in this economical way of modernising the cow-byre.

Pig Feeding Demonstration.

THE USE OF BALANCED AND UNBALANCED RATIONS FOR GROWING PIGS.

By C. A. MURRAY, M.Sc. (Agr.),
Senior Animal Husbandry Officer I/C., Matopo School of
Agriculture and Experiment Station.

Although it has been proved very conclusively that maize by itself is an exceptionally poor and unbalanced feed for growing pigs, a large number of pig farmers in the Colony still feed their pigs nothing but maize or maize and majordas during the winter months when no separated milk is available. The result is stunted, slow maturing, unprofitable pigs.

Most farmers do not realise that, generally speaking, the quicker a baconer or porker matures the cheaper it is to produce. It follows, therefore, that they should feed the growing pigs as much of a balanced ration as will mature them as early as possible. If fed less they will simply grow slower and cost more to produce.

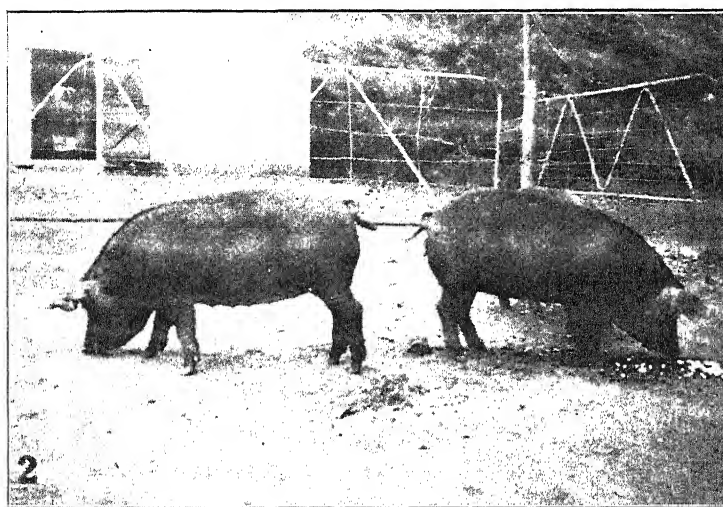
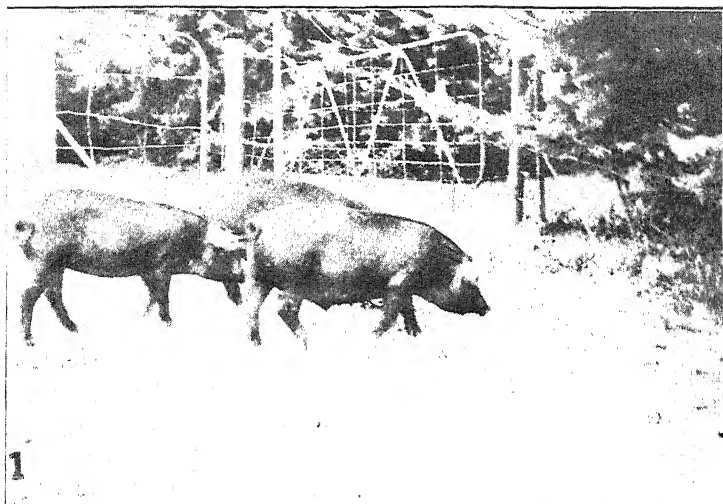
In order to demonstrate on the spot the unsuitability of a ration consisting of maize only for growing pigs a small trial was carried out at the Matopo School of Agriculture during the period February 9th to July 29th, 1934.

Ten young Tamworth X Large Black pigs weighing on the average 84 lbs. at 3 months of age were divided as equally as possible as regards age, breeding, weight and type into two similar groups of 5 per group.

The two groups were put in two different pens and fed on the following rations:—

Group I.: 100 maize meal.
1 salt.

Group II.: 90 maize meal.
10 meat meal.
1 salt.



Gr. I. (Maize only).

Unthrifty, slow maturing, unprofitable pigs.

Gr. II. (Maize and Meat Meal).

Thrifty, early maturing, profitable prime baconers.

They received their meal in the form of a thick slop and were fed twice daily as much as they would clean up in 15 to 20 minutes.

They always had access to clean drinking water, and both groups received daily a small amount of green food.

In Table I. data concerning the growth and feed consumption of the two lots of pigs are given:—

Table I.

	I.	II.
No. of pigs per group	5	5
Average initial weight lbs.	84	84
„ marketing weight lbs.	208	202
„ initial age days	94	94
„ age at marketing days	225	173
„ daily gain lbs.	.95	1.49
„ daily consumption of concs. per pig lbs.	5.3	5.0
Concs. per 100 lbs. gain in liveweight, lbs.	557	334
Cost per 100 lbs. of gain in liveweight*	£1 2s 8d	£0 14s 8d

Table I. brings out some very interesting information.

It will be noticed that both as regards age and weight the two groups of pigs were exactly the same at the commencement of the demonstration.

The maize fed pigs (Gr. I.) were finished and sent to the factory at the age of 7 months and 15 days and made an average daily gain of only .95 lbs., whereas the maize and meat meal fed pigs (Gr. II.) were finished and sent to the factory at the early age of 5 months and 23 days and made an average daily gain of 1.49 lbs. The pigs fed maize and meat meal were, therefore, marketed 52 days (nearly 2 months) earlier and gained on an average .54 lbs. more per day those fed maize only. These differences are enormous. As pointed out previously, the pigs were sty-fed. If they had run in the paddocks with a liberal supply of green fed, especially green lucerne, such extreme results would most likely not have been obtained, although the addition of 5-6% of meat meal would still have resulted in better and more economical gains.

*Maize meal 8s. per bag; meat meal £8; salt £3 10s. per ton.

As regards feed consumption the maize fed pigs actually ate .3 lbs. per day more than the maize and meat meal fed ones and required 223 lbs. (557-334) of concentrates more to produce 100 lbs. of gain in liveweight.

As shown in the table it cost £1 2s. 8d. on the maize ration and 14s. 8d. on the balanced ration of maize and meat meal to produce 100 lbs. of gain in liveweight, *i.e.*, a difference of 8s. per 100 lbs., or approximately 12s. per baconer. The feeding of the meat meal with the maize was, therefore, definitely more profitable and gave a considerably better financial return than the feeding of maize only, and farmers are strongly recommended to improve their ordinary pig rations by the addition of a small percentage of meat meal.

Other Suitable Rations.—Maize and 10% of meat meal, with some green feed, is, however, not the only suitable winter ration for growing pigs. The following rations will all give satisfactory results:—

1. Maize and separated milk or buttermilk (approximately 1 gallon milk should be fed with every 3-4 lbs. of grain).
2. 75 lbs. maize.
20 lbs. cowpeas or Kaffir beans.
5 lbs. meat meal.
3. 90 lbs. maize.
6-8 lbs. meat meal.
5-10 lbs. good quality bean hay (cut up).

To all these rations 1% of salt should be added.

Sunflower seed and ground nuts should *not* be included in the rations for bacon pigs, as they cause soft and oily bacon.

Conclusions.—The demonstration showed very clearly that maize alone, as fed by a large number of farmers in the Colony, is a most unsatisfactory, unbalanced and uneconomical concentrate to feed to growing pigs.

The addition of 10 per cent. of meat meal to the maize formed a well balanced ration on which the pigs grew well and it decreased the feed cost by approximately 8s. per 100 lbs. increase in liveweight, or approximately 12s. per baconer.

Other suitable rations for growing pigs are also given.

The White Man in the Tropics.

[The following addresses by Professor A. Grenfell Price, C.M.G., D.Litt., F.R.G.S., of the University of Adelaide, were broadcast in Australia on the 11th and 18th July, 1934.]

I have been asked to speak to you on the very important and unsolved problem of whether the white man, and particularly the Nordic white man, can settle permanently as a worker in the tropics. So this evening I will tell you about the question in general and what has happened in other lands, and next Wednesday I will deal with an aspect that is so vital to Australians—the problem of whether we, as a white people, can hope to live in and develop the vast, but almost empty, areas of tropical Australia—a region of nearly 1,150,000 square miles. I need hardly emphasise how vital is this question to the Commonwealth. Again and again other nations have called us “dogs in the manger,” because of our “White Australia” policy as regards these empty tropics, and only recently the Dean of Canterbury voiced a very usual opinion that we should give North Australia to the Japanese.

But we are not the only white people who are involved in the tropics. Britain, France, and the United States have great tropical possessions, and I found American scientists intensely interested in their own tropical problems in Florida, Panama, and Puerto Rico, and most anxious to hear Australian views.

The truth is that throughout the world leading scientists are disputing over this question of the ability of white people to settle the tropics. Some Americans, such as the well-known Professor Ellsworth Huntington, believe that whites cannot live there permanently, because they are destroyed by the climate. Other scientists, like General Gorgas (of Panama fame), and the Australian Dr. Ray Cilento, consider from the records of Panama and Queensland that the whites can colonise

the tropics if they overcome disease. A very great authority, the late Sir Andrew Balfour, took a mid-way position, but at his death he seemed to be swinging towards Cilento's views.

Definitions.—Let us begin by defining White, Settlement, and Tropics. By White we mean people who are white, or nearly white, such as the Europeans, the people of Canada, the United States, and Australia, and the near white peoples of Costa Rica or Cuba. By Settlers we mean people who live, work, and have families for generations in the tropics, and we exclude officials, missionaries, soldiers, and traders who go to the tropics only for a time. By Tropics we mean the earth's surface roughly between $23\frac{1}{2}^{\circ}$ Lat. N. and S., but this covers regions of very varied heat, rainfall, and humidity, and some areas will be far more suitable than others for the whites. We can exclude from our study many regions such as the African or Australian deserts, where no one can live, and many countries such as India or Java, where the whites will never form a working population as the coloured people and their cheap labour are overwhelmingly competitive. Thus we can narrow our inquiry to a few possible areas. The most important of these are North Australia, parts of North, Central, and South America, and the West Indies.

There are three ways in which scientists are attempting to examine the question—the methods of history, of statistics, and of the laboratory. Unfortunately, history is not a very accurate guide, as the progress of medical science has completely changed white prospects in the last few years. The statistical method is not wholly reliable. It is difficult to secure absolutely satisfactory figures of climate, hereditary, etc., even in civilised countries. The laboratory method is also uncertain, for when you test people under artificial conditions of heat or moisture in a laboratory you cannot reproduce the exact conditions which face them when they have to undergo acclimatisation in a tropical zone. By combining the three methods, however, one can find out a great deal about whether the whites are really making progress.

The White Man's Conquest.—The history of the white man in the tropics is very fascinating. From 1500 onwards European nations carried out a great pre-scientific conquest of the tropics. The Portuguese, Spaniards, English, Dutch,

French, and other nations poured into tropical Asia, Africa, America, and Australia, and either conquered or destroyed the native coloured peoples. Before very long, however, the tropical diseases and tropical peoples began to regain their own. In India, Java, Africa, or Mexico, the whites continued to hold sway as governors or traders, but each generation returned home, for if they remained they were absorbed like a river flowing into an ocean. In sparsely-inhabited countries, such as the West Indies, the whites destroyed the natives, but, instead of working themselves, the whites brought in negro slaves, and these negroes increased so rapidly that the white masters were soon absorbed. In India, the Portuguese tried the interesting experiment of deliberately breeding a half-caste people, but even this proved impossible, and ultimately the half-castes will be absorbed. Nevertheless, this white pre-scientific wave left some interesting flotsam and jetsam, and many fascinating books have been written on the little communities which have survived. Central America and the West Indies are full of such groups of white people, and, perhaps, we might even call the settlement at Darwin one. In 1932 and 1933 I was lucky enough to examine a number of such communities—Costa Rica in the Central American highlands, where an almost pure Spanish community has survived for 400 years; Jamaica, where a German community came about the same time as the German pioneers of South Australia; and the little and almost unknown island of Saba, where an English-Dutch community has kept almost pure white since the days of the English buccaneers and first Dutch planters—a period of 250 years.

Without going into scientific details, I will simply say that the evidence shows that white men can live and work for generations in the more favourable tropics, provided that they are protected both from disease and from the presence of coloured races, who are usually unhealthy, and are far more dangerous to the white man than any tropical climate. In Costa Rica one found a white Spanish community—artistic and educated—which had kept pure white because the people had been isolated on the plateaux, and because the negro had been excluded until comparatively recent days. This exclusion of the negro is of the utmost importance. Only this week a

letter came from an American scientist in Costa Rica to say that the Government so fears the rapid increase of the negro population that it is completely prohibiting negro immigration. It is the same in Saba. There one found a very fair type of pure white English-speaking people who had always done a great deal of their own hard work, but are now in danger, like the Costa Ricans, of being absorbed by negroes.

Control of Tropical Diseases.—After the old pre-scientific invasion of the tropics by the whites had failed, a new and far more promising invasion occurred. From 1890 onwards the British and American scientists learned the control of hookworm, yellow fever, malaria, and many other tropical diseases, and the worst enemies of the whites were partly subdued. On the Panama Canal, for example, "the pest hole of the world," the Americans showed that it was possible to secure a lower death rate than in the most healthy cool temperate countries, and the white death rate to-day is lower than even that of Australia or New Zealand. I spent some three weeks with American scientists in Panama, and saw white Americans who, with very few vacations in the United States, had carried out the hardest physical labour in the workshops for nearly thirty years. One also saw whites of the second generation who were doing the hard work perfectly well. As for the tropics injuring children, an exhaustive examination in 1930 showed that white children in Panama were, on the average and right up to the end of their high school days, of higher standard than similar white children in the United States. The same thing is going on in Southern Florida, where white fruitgrowers are working in a climate that is truly tropical—and the same type of evidence is now coming from the white sugar growers on the Queensland coast, who are actually doing the work that the Americans think no white man can possibly perform. We could, however, copy much from the Americans at Panama, for their control of disease, hygiene, and sanitation, and their methods of housing, clothing, and diet are unequalled anywhere in the tropical world. Our figures in Queensland would be even better if we would follow some of their ideas.

We must not, however, be too optimistic because of these successes. What is really happening in Florida and Queens-

land is that the white man, in particularly favourable regions where economic factors are particularly suitable, is beginning to penetrate the margins of the tropical zone. The great American doctor, General Gorgas—who conquered yellow fever in Cuba and Panama—made the mistake of being over-optimistic because of his successes, and thought quite wrongly that the whites would be able to colonise any part of the tropics. In reality, we are just beginning to understand that we are facing a huge and complex scientific problem, and that the future progress of white people in the tropics depends on a large number of geographic and economic controls. To take only one example, even a small region like Panama has great local varieties of climate, and there are probably in the climate, as affecting white people, a number of factors that are as yet unknown. Similarly, one race is more suited to the tropics than another, and even in a single race there are some individuals who are suited to the tropics, and others who can never acclimatise. This point was strongly emphasised by Dr. Sunstroem, when working in tropical Australia. The Americans are now talking about establishing in Panama a Research Institute to study the process of acclimatisation in various individuals, and a branch of such an institute would be of extraordinary value if founded to study thoroughly the effect of climate on white workers on the Queensland coast.

Soil.—Another vital control is soil. The world is gradually abandoning the old fallacy that almost all tropical soils are fertile. Australia, for example, would have saved a vast wastage in lives and expense had she realised that her Northern Territory soils are some of the poorest anywhere.

Housing.—Isolation is also important. We are beginning to realise that loneliness and inter-breeding have harmed many white communities more than tropical climates, and that small scattered settlements, such as some of those in North Australia, have little chance of meeting with success. Comfort is also of vital importance, particularly for women. One of the greatest hopes for white settlement in the tropics lies in air conditioning the houses. Very soon the white man in the tropics may be able to control the temperature of his dwelling as easily and effectively as the American controls the winter temperature by central heating. Then again, there

is the importance of social habits and of food and drink. Many failures in the tropics, particularly British failures, have been partly due to ridiculous clothing, heavy unsuitable diets, and alcoholic excess. Again and again when a young man died of drink in the West Indies, his parents were charitably informed that he had died of fever, and that good old whipping post—the tropical climate—took the blame. Again, we are beginning to realise how dependent the white peoples of the tropics are on temperate policies and markets. The Americans turned Puerto Rico and Cuba into lands of one crop industry—dependent on the cool temperate sugar markets. Now the United States is refusing to pay a profitable price for sugar, and when the unhappy, starving Cubans explode in riot and revolution, the supposed instability of a tropical people is blamed.

The Colour Barrier.—Most important of all we are beginning to realise that the greatest barrier to white settlement in the tropics is neither climate nor sickness, but the presence of vast masses of coloured peoples, who, as we know from the history of the Kanakas in Queensland, lower the standard of living, create reservoirs of disease, and form the means by which the whites can shirk doing the essential physical work.

From Washington to the Equator, every American scientist I encountered said, “You Australians are the wisest people on earth with your ‘White Australia Policy,’ ” and this dictum rests on indisputable facts. The health of white people in the Southern United States suffers appallingly from the presence of millions of negroes, while the West Indies and Central America are steadily going back. Jamaica, for instance, which once had thousands of white settlers, is now coloured to 96 per cent.

In this address I have tried to explain the general controls which govern white settlement in the tropics, and I have attempted to give you some idea of the great question in other parts of the globe. Next Wednesday, I will apply some of these principles to our own great problem, and will deal with our strange record of success and failure in the northern tropics, and the difficulties that confront Australians—or any other people—white or coloured—who attempt to settle the North of this great continent.

THE PROBLEM OF NORTH AUSTRALIA.

In my address last week I told you about the general question of white settlement in the tropics. I explained why the white invasion of the tropics failed in the days before modern science, and why the new and scientific invasions of the marginal tropics was meeting with some success. Finally, I tried to show that the future progress of white settlement would depend not merely on the successful combating of tropical climate and disease, but upon many other factors, such as soils, communications, housing, food, and drink, the exclusion of coloured peoples, and economics. To-night, I will apply these general principles to the history and prospects of white settlement in tropical Australia, and will deal with the pre-scientific invasion which failed, the new scientific invasion which appears to be making some headway in Queensland, and the factors which will determine whether any nation, white or coloured, can settle the North of this great continent.

As the Spanish say, "There are tropics and tropics," and we cannot begin to understand the problem of our North unless we realise that we keep a variety of tropics in North Australia. While we possess no equatorial lowlands, like the Congo or Amazon Basins, we have four other kinds of tropics: the tropical trade wind coast of Queensland; the tropical plateaux; the interior deserts of Western Australia, Queensland, and the Northern Territory; and the wet-dry region, that great belt of country, with a monsoonal rainfall in summer and a drought in winter, which runs right around the Australian North and North-West coast. Throughout the world the high plateaux with their cooler climates are the most suitable parts of the tropics for white settlement, but in Australia, out of 46,000 square miles of tropical plateaux over 2,000 feet in elevation, only 14,000 square miles of Queensland plateaux have rainfall and soils sufficiently good to support many whites. Also, we can eliminate completely from the viewpoint of any close white settlement (except, perhaps, for a few temporary mining camps) the whole of the desert or arid regions which have less than 15 inches of rainfall—regions which comprise not less than 700,000 square miles. Thus, we need consider only the Queensland coastal margin backed

is the importance of social habits and of food and drink. Many failures in the tropics, particularly British failures, have been partly due to ridiculous clothing, heavy unsuitable diets, and alcoholic excess. Again and again when a young man died of drink in the West Indies, his parents were charitably informed that he had died of fever, and that good old whipping post—the tropical climate—took the blame. Again, we are beginning to realise how dependent the white peoples of the tropics are on temperate policies and markets. The Americans turned Puerto Rico and Cuba into lands of one crop industry—dependent on the cool temperate sugar markets. Now the United States is refusing to pay a profitable price for sugar, and when the unhappy, starving Cubans explode in riot and revolution, the supposed instability of a tropical people is blamed.

The Colour Barrier.—Most important of all we are beginning to realise that the greatest barrier to white settlement in the tropics is neither climate nor sickness, but the presence of vast masses of coloured peoples, who, as we know from the history of the Kanakas in Queensland, lower the standard of living, create reservoirs of disease, and form the means by which the whites can shirk doing the essential physical work.

From Washington to the Equator, every American scientist I encountered said, “You Australians are the wisest people on earth with your ‘White Australia Policy,’ ” and this dictum rests on indisputable facts. The health of white people in the Southern United States suffers appallingly from the presence of millions of negroes, while the West Indies and Central America are steadily going back. Jamaica, for instance, which once had thousands of white settlers, is now coloured to 96 per cent.

In this address I have tried to explain the general controls which govern white settlement in the tropics, and I have attempted to give you some idea of the great question in other parts of the globe. Next Wednesday, I will apply some of these principles to our own great problem, and will deal with our strange record of success and failure in the northern tropics, and the difficulties that confront Australians—or any other people—white or coloured—who attempt to settle the North of this great continent.

THE PROBLEM OF NORTH AUSTRALIA.

In my address last week I told you about the general question of white settlement in the tropics. I explained why the white invasion of the tropics failed in the days before modern science, and why the new and scientific invasions of the marginal tropics was meeting with some success. Finally, I tried to show that the future progress of white settlement would depend not merely on the successful combating of tropical climate and disease, but upon many other factors, such as soils, communications, housing, food, and drink, the exclusion of coloured peoples, and economics. To-night, I will apply these general principles to the history and prospects of white settlement in tropical Australia, and will deal with the pre-scientific invasion which failed, the new scientific invasion which appears to be making some headway in Queensland, and the factors which will determine whether any nation, white or coloured, can settle the North of this great continent.

As the Spanish say, "There are tropics and tropics," and we cannot begin to understand the problem of our North unless we realise that we keep a variety of tropics in North Australia. While we possess no equatorial lowlands, like the Congo or Amazon Basins, we have four other kinds of tropics: the tropical trade wind coast of Queensland; the tropical plateaux; the interior deserts of Western Australia, Queensland, and the Northern Territory; and the wet-dry region, that great belt of country, with a monsoonal rainfall in summer and a drought in winter, which runs right around the Australian North and North-West coast. Throughout the world the high plateaux with their cooler climates are the most suitable parts of the tropics for white settlement, but in Australia, out of 46,000 square miles of tropical plateaux over 2,000 feet in elevation, only 14,000 square miles of Queensland plateaux have rainfall and soils sufficiently good to support many whites. Also, we can eliminate completely from the viewpoint of any close white settlement (except, perhaps, for a few temporary mining camps) the whole of the desert or arid regions which have less than 15 inches of rainfall—regions which comprise not less than 700,000 square miles. Thus, we need consider only the Queensland coastal margin backed

by its comparatively small plateaux, and the wet-dry belt of monsoonal country running inland from the North and North-west coast. Australians should never forget that these two regions are of entirely different character. The Queensland coast and plateaux are really promising, for they possess patches of excellent soil and a good and well-distributed rainfall from the monsoons and south-east trades. The Northern and North-western coastlands are entirely different. Most of the soils are poor, leached, and deficient in plant food. During six to eight months the country is almost drought-stricken. In summer, much of it is flooded by terrific rains, some of the rivers rising 50 to 60 feet.

Development of Our Tropical Territories.—Last time I explained how in the days before modern science the whites invaded the tropics, and how in almost every region their penetration failed. From 1824 onwards the whites entered the Australian tropics, partly as squatters and partly as agriculturists on the Queensland and Northern Territory coasts. From 1824 to 1849 the British planted small stations, such as Port Essington in North Australia, and South Australia founded and maintained the Northern Territory as a dependency from 1868 until in 1911, when the Commonwealth took control. From the sixties onwards Australia also saw the development of Northern Queensland by pasturing, agriculture and mines.

This tropical invasion took the usual course. The whites believed that it was impossible for them to work in the tropical climate, and they imported various coloured races which proved hotbeds for diseases that affected the whites in turn. From 1863 to 1891 Australians brought 46,000 Kanakas to Queensland, and from 1874 onwards the Northern Territory permitted the entrance of thousands of Chinese. Few people now realise that in 1876-7 the Japanese Government emphatically refused an official offer by South Australia for an extensive Japanese settlement in the Northern Territory, including free transport for the first 200 Japanese.

A Lost Opportunity.—This influx of coloured people to our continent had the same tragic results as in the West Indies and other parts of the world. We Australians, who had entered into possession of what might have been a marvellous biologi-

cal laboratory of continental magnitude and free from the worst kinds of tropical sickness, brought in unhealthy types of coloured people who riddled the country and its white inhabitants with tropical disease. In the Northern Territory, during the seventies, white men and Chinese coolies died like flies, while in Queensland the "dreadful eighties" saw a Kanaka death rate four times as great as that of the white inhabitants, and a white mortality that became 50 per cent. greater than that of any other State. Yet, even in these circumstances, events showed the fundamental difference between Queensland and North Australia. In both regions pasturing and mining made progress, but while in Queensland the whites and Kanakas established sugar, cotton, fruit, and other tropical industries, in the Northern Territory with its seasonal rainfall, poor soil, isolation and pests, such as the white ant and rat, the whites and Chinese met with no success. The close of the century saw North Australia stagnant save for cattle, mining, and pearling, and for a plantation system of agriculture—as usual unhealthy—established on the Queensland coast.

A Scientific Invasion.— Yet, while the pre-scientific invasion failed in Australia as in other countries, a scientific invasion from 1900 onwards has made progress, as is the case in Panama and in Southern Florida, which latter is a moderately tropical region very like the Queensland coast. Under the much-criticised White Australia Policy the nation deported the Kanakas, and by a health campaign against hookworm, leprosy, malaria, and other diseases, made the health and vital statistics of Queensland as good, or better, than those of any other State. To the utter astonishment of the scientists of all nations, we established a working population of 150,000 white people in North Eastern Queensland—the largest population of working Nordics in any part of the tropics. There is, of course, the question of alien Italian penetration in the most northern sugar districts, and it is very significant that in these areas foreigners or naturalised subjects number no less than 43 per cent. The Sugar Committee of 1931 reported, however, that the flow of alien immigration had declined; that the problem was passing through a transitory stage; and that satisfactory communities would be evolved out of the communities in the far North. White Australians

of British extraction have shown that they can do all the heavy labour in sugar and other industries, and before the depression they were bringing the costs of sugar production down towards the cost of production in coloured labour countries. In this respect, mechanical improvements will be of vast importance. In Florida and Jamaica I saw machinery which will eliminate almost all the hard manual labour in the sugar industry. While, however, this machinery will improve the prospects for white workers, it will spell stark naked tragedy for the wretched coloured peoples whom the white man has forced into one-crop industries.

Remarkable Physical Phenomena.—In 1924 a scientific investigation of certain Queensland towns disclosed remarkable phenomena. Contrary to all previous beliefs, white residents, even of the second and third generations, seemed to be healthy and strong. Tropical-born women averaged larger families than immigrant women from the cool temperate zone, and the most healthy people were those who did hard manual work. There remain two dangers in Queensland. First, the experiment is very new, and we are by no means certain of the continued effects of climate. Dr. Cilento considers that there is beginning to be a very definite type of North Queenslander or tropical-born Australian who moves slowly and conserves his muscular heat-producing energy in every possible way, but that this type is not lacking in muscular strength, while his endurance is equal in his own circumstances to that of the temperate dweller in his. Sir George Buchanan, in his great report on the Northern Territory, produced evidence to the effect that white labour there was from 10 per cent. to 35 per cent. inferior to that in the temperate zone.

The second danger in Queensland is that the white industries are uneconomic in the sense that their costs of production are far above world average, and that Australia is being forced to pay inordinately high prices for such products as sugar and bananas to allow the white population that standard of living which is essential if whites are to survive in the tropics. Yet, Queenslanders can justly argue that their industries are now no more uneconomic than most of the tariff-propped indus-

tries of temperate Australia. As Keynes and other economists confess, the tariff-mad and nationalistic nations are boxing themselves in water-tight economic compartments, and we must all face artificial industries and a lower standard of life.

Cattle-raising—A Probable Solution.—While the whites have succeeded in tropical Queensland, in the rest of North Australia, save in cattle, they have met with practically no success. It is a matter of sympathy that in the Northern Territory, for example, the figures of deaths, illegitimate births, serious crime, suicides, and drunkenness are far higher than those for any other division of the continent. Such figures are not necessarily due to the tropical climate, for isolation, a mixed population, poor diet, and frontier conditions take their toll from the unfortunate people. Nevertheless, it is significant that South Australia and the Commonwealth fruitlessly expended enormous sums of money in vain efforts to develop a huge area which now contains less than 4,000 whites. From 1911 to 1930 the Federal Government spent over £11,000,000, and in 1928-29 alone made a loss of £576,000, or about £150 per white person, while under Federal control the costs of working the Northern and Central railways have exceeded the revenue by nearly 100 per cent. It is small wonder that American scientists, in a recent world survey, have pointed out the utter futility of Australia wasting vast sums in attempting to develop agriculture and close settlement in her North Coast lands of poor soil and uncertain monsoonal rains. The only real hope lies in the cattle country which runs across the continent from Queensland to Western Australia between the central deserts and the coastal regions. Here, on stock routes and water supplies, we should spend as much as we possibly can, and it is splendid to know that the motor transport unit, which the Federal Government is subsidising, may solve the railway problem, and is already reducing costs by 50 per cent.

Segregation of the Native Race.—Outstanding questions of North Australia are the aboriginal and half-caste problems. It is now generally recognised that we should try to segregate the blacks, where it is possible, for example, to Melville

Island and Arnheim Land. As regards the thousands of aboriginals who have access to settled country, the best we can hope is to absorb them as the Americans have absorbed the Red Indians. It is interesting to note that the recent Vice-President of the United States was legally an Indian—a ward of the State. The Australian half-castes are now increasing at the rate of 800 per annum, and one believes that the Protector at Darwin is right in trying to marry these half-castes to one another, and the surplus girls to white people, rather than force them back to the aboriginal camps.

Successful Tropical Settlement.—In conclusion, one would say that history and science provide the answer to those who ignorantly criticise our empty North and the policy of White Australia. The only parts of our tropics which any nation—white or coloured—can hope to settle closely are the coasts and highlands of Eastern Queensland, and here we have already planted successful white industries and a white population which is apparently teaching the most extraordinary and unexpected lessons to the whole world. The remainder of North Australia is at best a cattle country. We have poured out £17,000,000 in unsuccessful attempts to settle one portion—the Northern Territory. Agriculture, with coloured Chinese labour, has been an utter failure, and the Japanese very wisely refused our invitations when we invited them in. If, despite such a record, the Dean of Canterbury, or Dean Inge, or Mr. Beverley Nicholls continue their criticisms of our supposed selfishness, Australians might humbly ask them to visit the West Indies, and study, as I did recently, the tragic problems of race, health, and economics, which were created by the importation of negro slaves.

Scientific Research Demanded.—What is the practical lesson of the two addresses? It is that the Australian Governments of all parties should face their problems in the tropics, not as questions of politics, but of science, and that before more money is lost in attempts to plant white settlers and tropical industries they should prepare the way by careful scientific research. To take only one problem—that of agriculture in the Northern Territory—almost every one of the few soil

analyses have been disappointing, and even black soil which I brought down from the Adelaide river flood plains proved deficient in potash. Yet, despite the advice of Sir George Buchanan, the Government, only a few years back, again attempted to foster by subsidy a one-crop peanut industry on soils which a later soil analysis proved unsatisfactory. We now know that adequate scientific work in the Northern Territory could have saved the nation a loss of millions of pounds, and the people of Australia have the right to ask that no more money be wasted without the most careful and impartial examination by highly-trained scientists.—*Queensland Agricultural Journal*.

Soil Conservation Advisory Councils.

At the end of October last two such Councils, one for Mashonaland and one for Matabeleland, were appointed by the Honourable the Minister of Agriculture and Lands, in terms of Government Notice No. 638 of 26th October, 1934.

The functions of these Councils are:—

- (1) To recommend to the Honourable the Minister means whereby the objects of the Rhodesia Agricultural Union's Soil Erosion Committee's report can be achieved as opportunity offers from time to time and to prepare draft legislation for consideration.
- (2) To carry out propaganda work for the advancement of a national policy of soil conservation.
- (3) To collect information and data relating to soil conservation.

The Councils are comprised of representatives of the Rhodesia and the Matabeleland Agricultural Unions, the Rhodesia Railways and the Land and Agricultural Bank of Southern Rhodesia, and Government officials responsible for Native Administration, Mining, Roads, Forestry and Irrigation.

Council meetings have been held and a considerable amount of preliminary work has already been dealt with. The following are some of the matters being attended to.

In order to further a national policy of soil conservation, it has been recommended that a Soil Conservation Congress be held annually at selected centres, and it is hoped to arrange for the first Congress to be held later in the current year. Such a Congress will be in the nature of a general tour of a selected district on similar lines to those tours which some few years ago were very successfully instituted by the Maize Growers' Association. Farmers' Associations would be asked to send representatives and Government officials would

be present to discuss the various aspects of soil conservation. It is considered that these Congresses will prove of great value not only to the individuals taking part in them, but also to the Councils in enabling them to get in touch with the representatives of the farming community.

The formation of local sub-committees by Farmers' Associations, to deal with soil conservation and form a means of closer *liaison* between the Councils and the Associations, is recommended, and the various Agricultural Unions and Federations are being circulated on this matter.

It has also been recommended that Government engineers and others should deliver short addresses to as many Farmers' Associations as possible, and arrangements are now being made to this end.

In addition the Associations will be circularised from time to time by the Councils and afforded the latest information relating to soil conservation. It is intended to publish from time to time in the Press short articles relating to the work of the Councils, and, also short articles relating to various aspects of soil conservation.

Included among other matters dealt with by the Councils are the prevention of veld fires, the insertion in title deeds and leases, etc., of clauses relating to the carrying out of necessary conservation works on farms, erosion in Native Reserves, and general propaganda work in advancement of a national policy of soil conservation.

A Government Soil Conservation Experiment Station has been established just outside Salisbury on Messrs. Newmarch and McLean's farm "Glenara," and very valuable information is already being collected from there. It is hoped to establish a further Experiment Station elsewhere in the Colony during the present year.

The Councils are putting in a great deal of hard work, and it is to be hoped that their efforts will be rewarded by the whole-hearted support of the Colony.

Schedule of Rainfall for Week ending 29th January, 1935.

	Total for week.	Total since Oct. 1st.	Normal to date.
Beitbridge	Nil	5.17	8.22
Bulawayo	Nil	14.78	14.61
Essexvale... ..	.03	19.95	15.01
Fort Rixon ... ..	.10	15.58	13.78
Gwanda ... ..	.06	8.20	12.85
Inyati... ..	.02	20.61	15.47
Matopos... ..	.02	14.03	14.99
Nyamandhlovu ...	Nil	13.78	14.28
Bikita	1.68	32.77	18.33
Gutu ... ..	.23	26.18	16.68
Shabani... ..	.15	12.65	12.85
Fort Victoria ... ..	.15	13.23	15.49
Chipinga... ..	1.28	24.59	22.85
Melsetter... ..	2.04	27.86	...
Enkeldoorn ... ..	.04	25.81	17.87
Gwelo... ..	.05	24.83	16.00
Hunters Road	Nil	21.32	17.72
Mtao ... ..	.15	18.02	17.13
Que Que... ..	Nil	22.24	16.18
Selukwe ... ..	.58	44.16	21.87
Plumtree... ..	Nil	10.05	14.75
Wankie ... ..	.17	18.05	14.13
Beatrice ... ..	.01	23.96	18.78
Gatooma... ..	Nil	19.77	18.07
Hartley	Nil	25.63	18.74
Makwiro	Nil	23.33	19.69
Headlands ... ..	.33	32.73	21.92
Inyanga ... ..	.07	36.13	20.84

	Total for week.	Total since Oct. 1st.	Normal to date.
Inyazura... ..	.99	22.78	21.32
Macheke... ..	.07	26.09	20.70
Marandellas... ..	.26	28.33	20.79
Mrewa... ..	.51	20.37	20.04
Odzi	1.17	21.86	23.36
Rusape ... ..	.61	20.89	19.25
Umtali ... ..	.36	22.37	17.99
Arcturus... ..	Nil	40.16	21.75
Bindura... ..	.31	32.60	17.31
Concession	4.39	46.62	20.79
Glendale... ..	1.40	31.25	19.68
Mazoe... ..	.58	31.95	18.79
Norton ... ..	.06	18.71	21.40
Salisbury... ..	.06	26.51	17.60
Shamva ... ..	.45	27.29	18.99
Banket ... ..	...	...	18.12
Miami	4.87	30.45	16.92
Sinoia ... ..	.08	32.52	18.59
Sipolilo ... ..	.89	24.60	19.14
Mtoko ... ..	.65	29.53	17.65
Victoria Falls ... ..	.03	15.44	16.65
Mount Darwin... ..	.70	29.30	...

Southern Rhodesia Weather Bureau.

DECEMBER, 1934.

Pressure.—Average barometric pressure was well below normal in the extreme north and above in the south-east owing chiefly to the activities of the Equatorial low which tended to centre in the Zambesi Valley.

Temperatures.—Average temperatures were well below normal. Night temperatures fell very low about the 20th and it is possible that frost may have occurred.

Rainfall.—Rain was fairly general during the month, with the exception of a welcome fine period extending from the 20th to the 26th. The total for the month was about 2 inches above normal, all areas being well above normal, except South Matabeleland. The total for the season up to 31st December is about 4 inches above normal.

Rainfall in December 1934, in Hundredths of an Inch. Telegraphic Reports.

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal
...	21	11	8	64	39	45	83	1	49	12	28	12	...	1	...	1	...	...	...	...	...	...	..	12	78	20	8	6	...	499	488
...	...	2	15	18	118	53	24	3	71	37	105	8	...	16	...	26	1	...	...	...	...	...	...	...	42	65	85	51	...	740	536
14	48	51	5	15	53	6	5	7	59	2	17	36	...	2	...	83	4	2	...	...	...	...	...	...	156	7	149	30	...	765	776
5	...	38	4	63	22	153	44	42	145	102	115	48	1	...	...	10	2	...	...	...	...	...	...	...	41	23	45	5	...	908	679
...	33	17	...	25	39	26	68	78	80	91	47	9	...	...	...	27	1	...	...	...	...	...	22	...	56	13	...	...	11	643	553
14	17	36	50	96	26	65	60	43	69	72	120	119	14	...	...	28	...	...	...	...	...	...	...	...	11	...	39	49	...	941	718
23	7	62	29	34	73	56	47	72	82	108	43	110	8	...	...	35	...	...	...	...	...	...	...	...	73	9	32	31	...	939	682
11	7	77	26	101	46	74	92	58	63	55	97	131	27	1	...	33	1	...	...	...	...	...	...	...	68	40	55	138	36	1237	719
...	1	53	17	5	63	94	46	89	87	78	48	98	57	...	18	26	20	5	...	...	...	...	...	...	32	...	94	27	53	1011	648
...	51	9	1	13	31	83	112	42	84	61	56	199	71	...	...	1	...	...	...	...	...	...	...	...	37	89	140	43	...	1123	639
5	15	29	16	42	53	64	59	45	78	65	67	61	14	2	2	21	3	1	...	...	...	...	4	2	50	23	46	28	10	807	606

DECEMBER 1934.

Station.	Pressure Millibars, 8.30 a.m.	Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point F.	Cloud Amt.	Precipitation.		Altitude (Feet)
		Mean.						No. of Days									
		Absolute.		Max.		Nor- mal.		Dry Bulb.		Wet Bulb.					Ins.	Nor- mal	
		Max.	Min.	Max.	Min.	3 Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.								
Angus Ranch...	...	100	59	87.9	67.5	77.7	78.3	77.5	69.6	68	66	...	4.55	4.57	8	...	
Beit Bridge...	962.8	105	62	90.0	70.4	80.2	...	78.3	68.5	62	64	5.2	.74	2.45	17	1,500	
Bindura...	889.8	90	57	78.3	64.1	71.2	...	69.2	65.1	81	63	6.3	13.42	6.78	16	3,700	
Butawayo...	867.2	89	54	78.5	61.2	69.8	71.7	68.5	62.2	72	59	7.0	5.99	5.12	13	4,426	
Chipinga...	891.2	87	55	76.8	61.8	69.3	...	69.5	64.9	79	63	6.6	7.40	7.69	20	3,685	
Enkeldoorn...	856.3	87	62	76.4	58.9	67.6	70.7	66.8	61.5	75	58	6.0	8.29	6.53	15	4,788	
Fort Victoria...	894.2	93	51	81.0	62.3	71.6	73.0	71.5	64.4	70	62	5.7	4.54	5.63	12	3,571	
Gwaai Siding...	902.2	96	54	85.1	63.5	74.3	...	73.4	66.1	69	63	5.4	4.09	5.05	12	3,278	
Kwanda...	905.0	96	56	83.3	64.9	74.1	...	72.9	64.7	66	61	5.8	1.03	4.60	7	3,229	
Kwelo...	861.1	90	52	78.1	59.5	68.8	71.9	68.5	62.7	74	60	4.5	8.36	6.00	16	4,629	
Hartley...	883.7	88	54	79.9	61.9	70.9	73.8	70.2	64.5	74	62	4.4	6.30	6.86	16	3,879	
nyanga...	835.3	79	46	72.1	56.6	64.4	...	66.0	59.8	71	57	...	14.15	7.03	17	5,514	
Marandellas...	836.3	83	48	73.6	57.5	65.6	...	65.5	60.2	76	58	7.2	11.11	7.44	18	5,453	
Miami...	877.1	86	55	76.4	61.9	69.1	...	68.6	64.5	82	63	6.7	10.93	5.92	19	4,090	
Mount Darwin...	905.6	90	55	79.7	64.6	72.2	...	71.3	66.3	78	64	7.2	12.44	6.19	17	3,179	
Mount Nuz...	800.9	73	44	62.5	51.9	57.2	...	56.7	55.6	94	55	8.3	21.62	...	22	6,668	
Mtoko...	876.0	91	55	78.5	62.5	70.5	...	69.4	64.5	77	62	5.8	10.02	6.58	17	4,141	
New Year's Gift...	...	93	56	82.6	62.9	72.7	...	72.6	66.4	73	63	5.8	2.74	5.91	11	2,690	
Juanetsi...	960.2	105	55	89.3	66.6	77.9	...	77.4	69.8	70	67	6.4	1.81	2.82	8	1,581	
Juntree...	863.1	90	53	80.9	62.1	71.5	...	70.3	61.9	63	57	5.3	2.29	5.46	14	4,549	
Jue Que...	880.3	90	52	80.3	60.6	70.5	...	69.9	63.8	72	60	5.8	9.72	6.20	11	3,999	
Jusape...	860.9	89	48	76.8	59.2	68.0	...	66.5	61.1	74	58	6.4	7.83	7.53	17	4,648	
alisbury...	853.3	87	51	76.9	59.4	68.2	69.6	68.3	62.4	73	59	6.5	8.19	5.86	20	4,885	
thabantu...	906.1	99	57	83.1	65.6	74.3	...	72.8	65.6	70	63	6.1	4.97	4.80	12	3,193	
inolo...	886.7	89	55	80.0	62.7	71.4	...	70.6	65.5	77	63	...	8.18	6.89	16	3,795	
inilo...	883.6	85	55	76.6	62.8	69.7	...	69.7	63.7	73	61	6.6	11.58	7.04	17	3,876	
kapleford...	840.9	80	42	70.4	53.9	62.1	...	62.7	60.1	87	58	7.8	21.17	10.83	20	5,304	
Intali...	891.5	92	53	79.4	61.6	70.5	71.9	69.1	65.0	81	63	7.0	8.52	5.29	15	3,672	
Victoria Falls...	...	98	58	85.9	66.9	76.4	...	73.4	67.7	76	67	6.6	7.03	6.35	13	2,560	
Wankie...	924.8	99	65	86.2	69.0	77.6	...	75.1	68.8	75	65	6.6	10.20	4.77	16	2,997	

SOUTHERN RHODESIA.

Locust Invasion, 193

Monthly Report No. 25. December

During December egg-laying by the Red Locust (*Nomadacris septemfasciata* Serv.) has been reported in most districts of the Colony, and by the end of the month hoppers had been reported from fourteen districts.

All specimens of eggs and hoppers forwarded to Salisbury have been of the Red species. If the invasions by the Tropical Migratory Locust (*Locusta m. migratorioides*, Reh. and Frm.) were as great as indicated by reports and specimens submitted, it would seem that this species has not been very successful in respect to breeding this season, as the hoppers should have hatched out well in advance of those of the Red Locust and attracted earlier attention.

Enemies and Disease.—The invading locusts have suffered greatly from the ravages of parasites and particularly the fungus disease (*Empusa grylli*) which has apparently been favoured by the wet weather. There can be no doubt that the position has been greatly alleviated by these agencies, and it is not impossible that what threatened to be an overwhelming outbreak of hoppers may prove to be comparatively light. The position will, however, become clearer in the course of the next few weeks.

The white-bellied stork (*Abdimia abdimii*) has been much in evidence attacking the locusts, at least in Mashonaland, whilst flocks of the white stork (*Ciconia alba*) have been reported in one or two localities.

The usual enemies and parasites of eggs have been recorded, including *Stomatorhina lunata*, *Cantharid* beetles, etc.

Damage.—A considerable amount of young maize has been damaged in the maize growing districts, but has mostly either been re-planted or is reported to be recovering. Widespread damage to grazing is reported in Matabeleland. This damage has, of course, been inflicted by winged swarms.

Outlook.—The outlook is still somewhat obscure due to uncertainty as to the amount of eggs deposited before the majority of the swarms succumbed to parasites and disease. An element of uncertainty is also produced by the presence of scattered locusts in many parts, which may be more general than is known at present. Present indications are, however, to the effect that the prospects has greatly improved during the month.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

NOVEMBER, 1934.

AFRICAN COAST FEVER.

Charter District.—The mortality at the Greyling centre was three.

FOOT AND MOUTH DISEASE.

No developments.

ANTHRAX.

One case, a calf, in an old infected area, Gwelo district.

TRYPANOSOMIASIS.

One case in Melseketter district, three in Wankie district and two in Hartley district.

TUBERCULIN TEST.

Sixteen cattle were tested on importation with no reaction.

MALLEIN TEST.

Two horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa:—Cows 15, bulls 1, horses 2, sheep 991, pigs 14.

EXPORTATIONS.

To the United Kingdom *via* Union Ports in Cold Storage:—Chilled: Beef quarters, 4,247.

Meat Products.—From Liebig's Factory: Meat meal, 57,030 lbs.; corned beef, 28,944 lbs.; tallow, 27,291 lbs.; horns, 5,537 lbs.; hair, 1,332 lbs.; sinews, 10,280 lbs.

From Rhodesian Export and Cold Storage Co.: Beef fat, 28,084 lbs

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Farming Calendar.

FEBRUARY.

BEE-KEEPING.

In most part of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due. which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See *Rhodesia Agricultural Journal*, December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of goards. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gillias, larkspur, dianthus and pentstemon. The uower garden should be now looking its best, nearly all

plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohlrabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and calitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mash instead of dry food, chopped onions and thick milk, are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially

in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheesemaking, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any disagreeable flavour or colour, it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, $7\frac{1}{2}$ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

MARCH.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irriga-

tion, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles *at once*. Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) $1\frac{1}{2}$ ozs., treacle $\frac{1}{4}$ gallon (or cheapest sugar $2\frac{1}{2}$ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphids and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbages and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Expert.

This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 374. Fibre Crops—Deacan Hemp (*Hibiscus Cannabinuz*) and Sunn Hemp (*Crotolaria Juncea*), by J. A. T. Walters, B.A.
- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
- No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
- No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
- No. 634. Barley, by P. V. Samuels.
- No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
- No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
- No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
- No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
- No. 681. The Sunflower (*Helianthus Annuus*) (Revised), by S. D. Timson, M.C., Dip.Agric.
- No. 694. The Edible Canna (*Canna Edulis*), by D. E. McLoughlin.
- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip.Agric.
- No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
- No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
- No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
- No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
- No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
- No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
- No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.). A.I.C.T.A.
- No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
- No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

- No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
- No. 759. Witch Weed (*Striga Lutea*): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
- No. 768. The Ground Nut (*Arachis hypogaea*), by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
- No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
- No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
- No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
- No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
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THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant.
Department of Agriculture, Salisbury.

VOL. XXXII.]

MARCH, 1935.

[No. 3.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Trade Agreement with the Union.—The new trade agreement, which replaces the Customs Convention, takes effect from the 1st April, 1935, and continues, except for cattle and tobacco, until 31st March, 1937, and thereafter for periods of twelve months until notice is given for its termination. Articles IV. and V., dealing with the introduction of cattle and tobacco, duty free, into the Union read as follows:—

Article IV.—(1) The importation into the Union of cattle for slaughter from Southern Rhodesia shall not exceed 5,200 head per annum.

(2) The weights of such animals shall, on arrival within the Union, be, in the case of an ox, not less than 1,000 lbs., and in the case of a cow, not less than 750 lbs., or, alternatively, when the weights are taken at the point of despatch, 1,050 lbs. and 790 lbs. respectively.

(3) No fresh, chilled or frozen beef shall be imported into the Union from Southern Rhodesia; provided that the Livestock and Meat Industries Control Board of the Union may permit the importation into the Union from Southern Rhodesia or chilled quarters of beef, weighing each not less than 150 lbs., from oxen or cows which, when alive, weighed not less than 1,050 lbs. each or 790 lbs. each respectively; and provided further, that four such quarters shall be deemed to be a head of cattle for the purpose of paragraph (1).

(4) The Livestock and Meat Industries Control Board of the Union may, subject to the provisions of the preceding paragraphs, regulate the supply and control the distribution of the cattle and beef imported under this Article to areas in the Union in regard where to the said Board has the power to determine the number of cattle and the quantity of beef which may be brought into any such area.

Article V.—(1) During the period 1st July, 1935, to 30th June, 1936, Virginia type leaf tobacco grown in Southern Rhodesia, not exceeding 2,000,000 lbs. in weight, of grades purchased at not less than 1s. per lb. free on rail Salisbury, may be imported into the Union free of duty.

(2) After 30th June, 1936, the quantity of Virginia type leaf tobacco which may be imported into the Union free of duty during every period of twelve months commencing on the first day of July, shall be determined by the Tobacco Control Board of the Union. For the purpose of making such determination the Board shall estimate—

- (a) the quantity of Virginian flue-cured leaf tobacco required in the Union during any such period,
- (b) the quantity of such tobacco produced in the Union during the preceding period of twelve months,
- (c) the unsold stocks of such tobacco in the Union at the commencement of such period,
- (d) the quantity of such tobacco to be imported from Northern Rhodesia during such period.

The amount by which the quantity estimated under (a) exceeds the total quantity estimated under (b), (c) and (d) shall then be the quantity of such tobacco which may be

imported into the Union from Southern Rhodesia free of duty during such period. The minimum price free on rail Salisbury for the lowest grade of leaf that may be so imported shall be determined by the said Board.

(3) During the period 1st July, 1935, to 30th June, 1936, leaf tobacco grown in the Union, not exceeding 150,000 lbs. in weight may be imported into Southern Rhodesia free of duty.

(4) After 30th June, 1936, the quantity referred to in the preceding paragraph, of leaf tobacco grown in the Union which may be imported into Southern Rhodesia free of duty during any period of twelve months, may, by agreement between the contracting parties, be changed to conform with any variation of the quantity determined in terms of paragraph (2).

(5) The importation free of duty into the Union of Turkish leaf tobacco grown in Southern Rhodesia shall, during the period 1st July, 1935, to 30th June, 1936, not exceed 200,000 lbs. in weight.

(6) After 30th June, 1936, the Tobacco Control Board of the Union shall determine, in a manner similar to that laid down in paragraph (2), the quantity of Turkish leaf tobacco grown in Southern Rhodesia which may, during any period of twelve months, be imported into the Union free of duty.

Tung Oil.—A few further particulars with regard to tung oil are available from the latest circular of the National Paint, Varnish and Lacquer Association of America. Imports in pounds of oil to that country rose by 40 million pounds in 1933 to 119 million pounds, this figure being second only to the 1929 and 1930 imports of 120 and 126 million pounds. The area planted appears to have risen in June, 1933, to approximately 40,000 acres, an increase of about 11,000 acres since April, 1932. Two thousand acres have been planted in Burma and small areas have been successfully established in Australia. In New Zealand companies are being formed with the object of tung oil cultivation, one of which is reported to contemplate the establishment of 25,000 acres. Probably 50,000 trees were planted in the Misiones Territory, Argentine, by 1931, and there are probably 30,000 trees in Para-

guay. Russia has planted 1,730 acres, and it is stated that 41,990 acres will be required for that country's requirements in the paint and varnish industry. It is understood, however, that there are plans for growing 50—100,000 acres. American planters are now tending towards planting trees at an espacement of 16 ft. x 16 ft., giving 150 trees per acre, as this gives better soil cover in the initial stages and reduces cleaning costs. They recommend fertilising twice a year in quantities ranging from 2 lbs. per annum in the first year to 10 lbs. when in full bearing. The usual fertiliser is one, giving 5% ammonia, 7% phosphoric acid and 2% potash. Peruvian guano has given the best results. On a basis of 8.2 cents per lb. of oil in New York it is estimated that Florida growers will obtain a price of 23.42 dollars per ton of fruit (40 gallons of oil per ton), less 5.00 dollars for crushing. This price based on a figure of 8.2 cents per pound of oil in New York, and 40 gallons of oil per ton of fruit. Examination of the import figures reveals startling changes in the world price, namely 1922, 10.9 cents; 1929, 12.5 cents; 1933, 4.07 cents, and for the first ten months of 1934, 6.03 cents per lb. of oil. How much this is due to fluctuations in exchange is not explained.

Farmers' Day: Rhodes Matopo Estate.—A very successful Farmers' Day was held at the Rhodes Matopo Estate and Experiment Station on the 20th February. Some two hundred visitors attended and it was generally agreed that a very profitable and interesting day was spent by all those present.

The meeting was opened by Mr. H. H. Phillips, Chairman of the Matabeleland Agricultural Union, and before lunch addresses were given by Dr. A. E. Romyn, Chief Animal Husbandry Officer; Mr. C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; Mr. D. E. McLoughlin, Agriculturist; and Mr. G. H. Cooper, Poultry Officer. After lunch a tour of inspection was made of the livestock on the station, the animal husbandry and crop experiments and the poultry plant. The gathering broke up at about 5 p.m.

The crops and livestock were in excellent condition and were favourably commented upon by all the visitors.

Successful Horticultural Show at Bulawayo.—Probably one of the most successful Horticultural Shows ever held in Southern Africa was arranged by the Bulawayo Horticultural Society at the Show Grounds on February 23rd. The entries in all sections were numerous, but the outstanding feature was the excellent display of children's exhibits, which numbered one thousand. These included wild flowers and fruits, floral decorations, bouquets, grasses, photographs, trees and shrubs grown from seed, articles made from veld products, drawings, essays, poems, etc. The descriptions of Bulawayo Park and Fairy Tales based on Rhodesian flowers were remarkably good. One of the most pleasing events was the presentation made to the Honorary Secretary, Miss E. Mitchell, as a token of appreciation of her work for the Society. There is no doubt that the success of the Show was in a very great measure due to her efforts.

Mr. G. W. Marshall, the Horticulturist, was the judge, and was very agreeably surprised at the exceptional quality of many of the exhibits. The Dahlias, Asters, Cannas, Zinnias and Roses would have been a credit to any of the leading South African Shows.

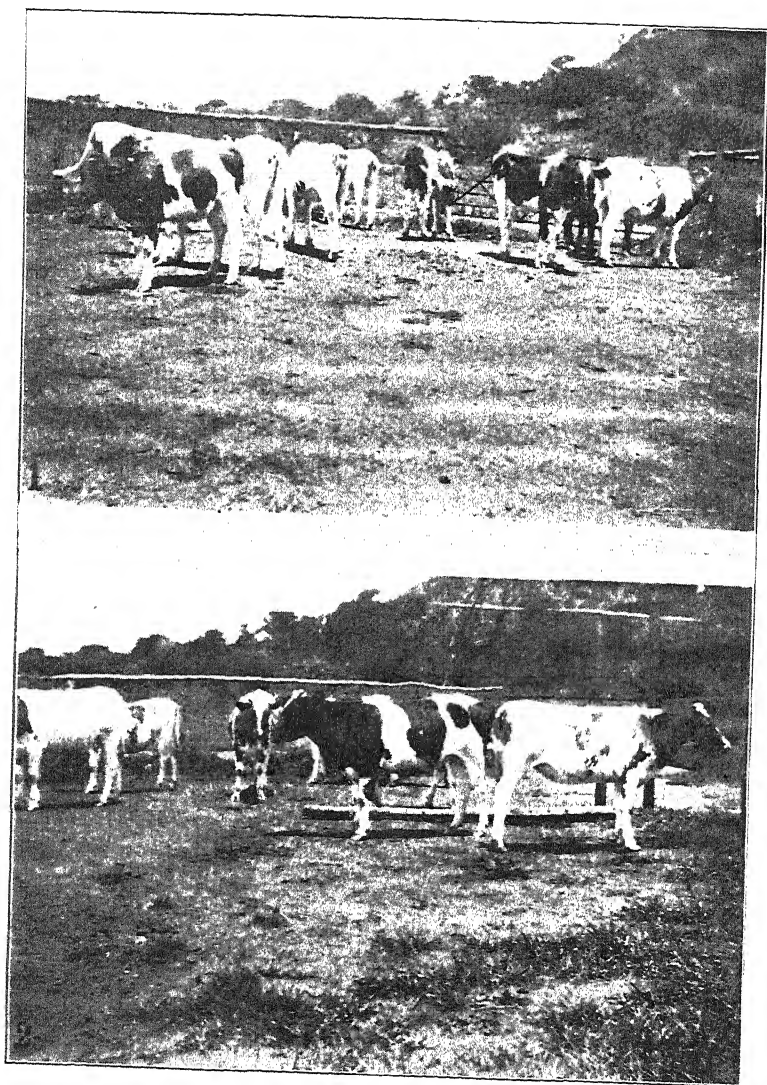
The Bulawayo Horticultural Society is to be congratulated on its success, and it is hoped that the children's sections will be copied at many centres throughout the Colony.

Germany Producing Sugar from Wood.—The production of sugar from wood by the well-known Bergius process has received favourable attention of the Reich Government and will in future receive all the benefits and concessions accorded to the beet-sugar industry, according to a report made public by the Department of Commerce. Special tax exemptions granted by law to new processes and inventions creating new industries are expected to be important factors favouring development of this new source of sugar.

Cattle fodder produced as a by-product of this process is said to have attracted the attention of agriculturists. The German Agricultural Council has instituted investigations regarding its practicability, and the Reich Food Bureau is expected to establish a good foundation for its development.

The Deutsche Bergin A.-G., of Ludwigshaven, undertook the practical exploitation of the process and has already concluded contracts with the I.G. Farbenindustrie covering small deliveries of the product needed by the latter because of certain advantages it offers in replacement of other materials for certain chemical uses. The productive capacity of the Mannheim-Rheinau wood-hydrolysis plant is to be increased and other plans involve the establishment of a wood-sugar plant at Regensburg.—(*Industrial and Engineering Chemistry*, News Edition, Vol. XII., No. 18, 1934, pp. 340.)

Chlorinated Rubber.—The new chlorinated rubber known as Alloprenol lately introduced by Imperial Chemical Industries, Ltd., is the first solid product of its kind to be manufactured in England. Alloprenol possesses a number of interesting properties which should make it useful for a wide variety of industrial purposes. As at present produced, it is a white, fibrous material containing 65 to 66 per cent. of chlorine, and having a composition corresponding approximately to $C_{10}H_{12}Cl_{17}$, both addition and substitution occurring at the same time in the chlorinating process. It is claimed to be remarkably resistant to attack by acids and alkalis at ordinary or higher temperatures; for example, concentrated nitric acid is stated to have practically no effect on Alloprenol at 80°-90°C. and it is unchanged after heating with 40 per cent. caustic soda solution for several hours. Hydrochloric acid at all concentrations does not attack Alloprenol at temperatures up to 100°C., and no discolouration results from 98 per cent. sulphuric acid at ordinary temperatures even after several days' contact. Alloprenol is equally resistant to aqueous solutions of oxidising agents such as permanganate, or the hypochlorites and bichromates, and it can also be safely used in contact with such corrosive gases as oxygen, chlorine and sulphur dioxide. Furthermore, Alloprenol shares with many other chlorinated products the property of non-inflammability; in prolonged contact with a naked flame it carbonises without burning or fusing.—(*Chem. and Ind.*, Vol. 53, No. 36, 1934, p. 761.)



GROUP 1.

GROUP 2.

The two groups of heifers at the conclusion of the experiment.

Economical Rations for Wintering Dairy Cattle.

By C. A. MURRAY, M.Sc. (Agric.),

Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.

During the dry winter months young heifers are usually badly neglected by many dairy farmers in the Colony and often stunted. In many cases the necessity for "assisting" such animals during the critical months is not yet appreciated and the result is stunted cows with limited production.

It has been pointed out previously ⁽¹⁾ that such heifers can be wintered very satisfactorily and economically on the following two rations:—

- (1) 7-8 lbs. maize stover per day.
8-9 lbs. maize silage per day.
1 lb. groundnut cake per day.
- (2) 2-3 lbs. maize stover per day.
8-9 lbs. maize silage per day.
4-5 lbs. cowpea hay per day.

To get some more information on the value of different home-grown rations for wintering purposes a further trial was conducted at this Institution during the period 24th August, 1934, to 7th December, 1934.

Animals Used.—Towards the middle of August, 1934, it was noticed that the young heifers in the Red Poll and Grade Friesland herds at this Institution could no longer maintain their condition on the best veld grazing available. They were then brought up, weighed and measured, and divided into two similar groups as regards size, age, breeding, weight, height and condition. There were 11 heifers in each group, varying in age from 8 months to 26 months.

⁽¹⁾ *Rhod. Agr. Journal*, Feb., 1934: Reprints of this article (Bul. No. 912) can be obtained from the Department of Agriculture, Salisbury.

Rations Fed.—Daily the two groups of heifers received the following rations:—

Veld hay (average quality)...	ad lib.	ad lib.
Silage (mixture of equal parts of maize and sunflowers)	3-5 lbs.	3-5 lbs.
Groundnut cake... ..	1 lb. (40% Dig. Cr. Prot)	—
Sunflower head meal ⁽¹⁾	—	3 lbs. (9.1% Dig. Cr. Prot)

Feeding and Management.—Each group of heifers was kept in a shaded pen 36 ft. x 45 ft. in which they received veld hay *ad lib* from racks. They received no veld grazing whatsoever.

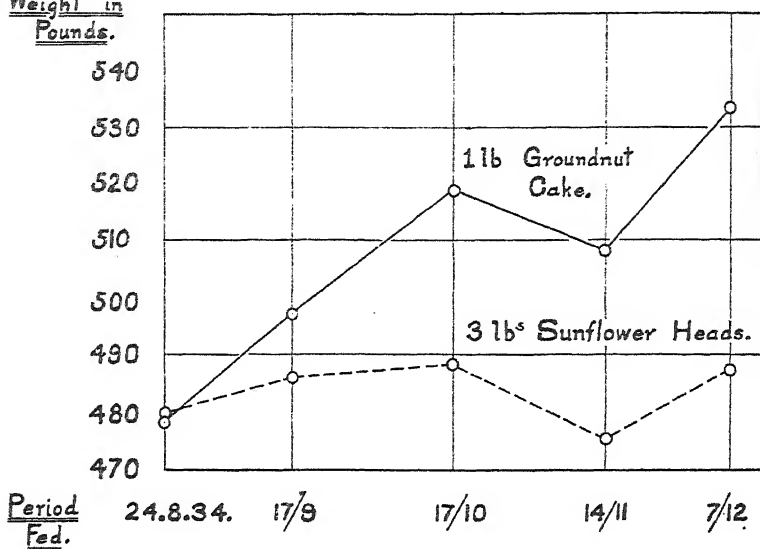
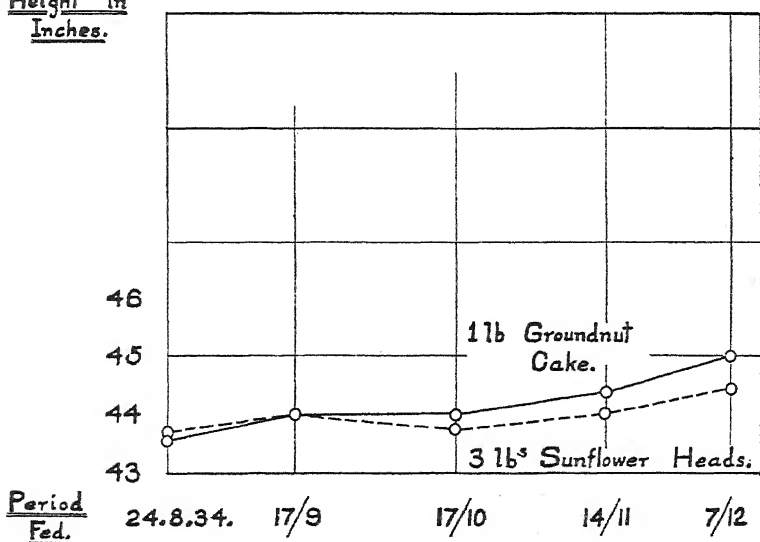
Every morning at about 8.30 they were brought to the stables, tied up, and each heifer given separately her ration of silage and groundnut cake (Gr. 1) or sunflower head meal (Gr. 2) When finished they were taken back to their pens. Daily at 2 p.m. they were taken out and watered.

TABLE 1.

Growth data of the two groups of heifers.

	Group 1.	Group 2.
<i>Growth in Weight—</i>		
Average initial weight, 24.8.34 ... lbs.	479	481
„ final weight 7.12.34 lbs.	533	487
„ total gain in weight lbs.	54	6
„ daily gain in weight... .. lbs.	.51	.06
<i>Growth in Height—</i>		
Average initial height, 24.8.34 ... ins.	43.4	43.3
„ final height, 7.12.34... .. ins.	45.1	44.4
„ total gain in height... .. ins.	1.7	1.1
„ daily gain in height... .. ins.	.016	.011

⁽¹⁾ This consisted of the heads and about 75% of the seeds ground up together. Feeding analysis by the Division of Chemistry as follows: Moisture 13.6%, Ash 7.7%, Cr. Prot. 12.3%, Fat 12.4%, Cr. Fibre 18%, Nitrogen-free extract 36%.

Weight in Pounds.Fig 1. Growth in Weight.Height in Inches.Fig 11. Growth in Height.

Growth.—From Table 1 it will be noticed that the Group 1 heifers gained on the average 54 lbs. each and the Group 2 heifers only 6 lbs. each. *i.e.*, an average daily gain in weight of .51 lbs. and .06 lbs. respectively.

In height Group 1 gained on the average 1.7 inch and Group 2 1.1 inch, *i.e.*, daily .016 inch and .011 inch respectively.

From the data in Table 1 and Figures 1 and 2 it is clear that Group 1, receiving in addition to their roughage 1 lb. of groundnut cake, definitely did better than Group 2 that received 3 lbs. of sunflower head meal instead.

At the conclusion of the trial Group 1 showed better condition and thriftiness than Group 2. However, although the Group 2 heifers practically only maintained their weights during the three months wintering period they made satisfactory skeletal development (as shown by their growth in height) and were by no means unthrifty and stunted. Actually they had sleek, thrifty coats, and although they did not have the excellent condition of the Group 1 heifers, they were well grown and well fleshed, and experienced cattle judges were of the opinion that their condition, thriftiness and general appearance were satisfactory from the standpoint of good dairy herd management.

It is an established fact that growing animals making large winter gains do not make such large gains in the subsequent summer as those making smaller winter gains, and that it is economically undesirable to feed young stock heavily during the winter months. A winter gain of 25-50 lbs. is usually considered very satisfactory for yearlings. Other experiments in progress at this Institution also indicate that yearlings fed a ration to maintain their weights only during the winter months make normal skeletal growth and grow out into normal, well developed animals.

Although, therefore, Group 1 did better than Group 2, both groups were wintered very satisfactorily from a practical point of view.

TABLE 2.

Average daily and total feed consumption and feed costs per heifer.

Group 1.

	Veld hay. lbs.	Maize silage. lbs.	Groundnut cake. lbs.
Average daily consumption per heifer	8.6	4.1	1
Total consumption per heifer ...	903	427	105
Average feed cost per heifer ⁽¹⁾ ...	4/6	2/1	7/11
Total	14/6		

Group 2.

	Veld hay. lbs.	Maize silage. lbs.	Sunflower head meal. lbs.
Average daily consumption per heifer	8.5	4.1	3
Total consumption per heifer ...	893	427	315
Average feed cost per heifer ⁽¹⁾ ...	4/6	2/1	6/4
Total	12/11		

Feed Consumption.—From Table 2 it will be seen that for a feeding period of 105 days, during the most critical months of the year, the total feed consumption per heifer was only 903 lbs. veld hay, 427 lbs. silage, and 105 lbs. groundnut cake for Group 1, and 893 lbs. veld hay, 427 lbs. silage and 315 lbs. sunflower head meal for Group 2. The total feed costs of the two rations were only 14/6 and 12/11 for Groups 1 and 2 respectively.

Considering the small amounts of feed consumed per heifer and the fact that all the feeds, except the groundnut cake in Ration 1, were farm grown, both the rations were satisfactory from an economical as well as a practical point of view.

⁽¹⁾ Veld hay 10/- per ton, maize silage 10/- per ton, groundnut cake £7 10s. per ton, sunflower head meal £2 per ton.

SUMMARY.

Two groups of dairy heifers were wintered from August 24th to December 7th, 1934, on two different rations.

Ration 1 proved more efficient than Ration 2, although both gave satisfactory results.

As a supplement to veld hay and silage, 1 lb. of groundnut cake (40% Dig. Cr. Prot) was better than 3 lbs. of sunflower head meal (9% Dig. Cr. Prot.).

There is little doubt that dairy farmers can winter their heifers satisfactorily and economically on practical home-grown rations.

ACKNOWLEDGEMENTS.

I am indebted to Dr. A. E. Romyn, Chief Animal Husbandry Officer, Department of Agriculture, Salisbury, for advice and constructive criticism and assistance in the preparation of this report; also to Mr. R. H. Greaves, Stockman, for weighing and measuring the animals and supervising the feeding.

Modern Culling of Laying Hens.

By G. H. COOPER, Assistant Poultry Officer,
Matopc School of Agriculture and Experiment Station.

The operation of culling or the sorting of the good from the bad amongst hens bred for egg production should be carried on all the year round.

Eggs.—Preliminary elimination of unprofitable birds commences in discarding unsuitable eggs for incubation. This operation is most important as it goes to the root of the existence of culls. For this reason there are some men devoting all their time and energies to the production of better stock; they are the stud breeders.

The commercial egg-farmer, therefore, will have this selection done for him if he purchases his stock from a reliable stud breeder, which practice is strongly recommended. If stock is not purchased annually in the form of day-old chickens then the commercial egg-farmer must go to considerable trouble and expense in selecting his breeding birds. The hens must be true to type and, more important from his point of view, have a record of at least 200 eggs in their pullet year of good standard size (2 oz.) quality, texture and shape. The male birds must, if possible, be even of better lineage than the hens from a production point of view and of robust vigour. As stated previously, the eggs from these selected pens must then be culled before incubation. Select only 2—2 $\frac{1}{4}$ oz. eggs of correct shape, good smooth texture and the correct colour, for the breed, *e.g.*, all Leghorn eggs must be chalk white. Eggs for incubation should not be more than 7 days old in order to hatch sound, robust chickens artificially.

Chickens.—On hatching, culling commences immediately by refraining from assisting weak chickens from the shell; these will only be culled in a few months time after they have cost a few shillings more, so don't throw good money after bad.

Any deformed or weakling chickens should be killed when the hatch is taken off. Thereafter, during the whole growing period, any chickens not growing out well should be examined, and if the cause can only be laid at the door of poor constitutional ability then they should be disposed of to the best advantage, which may mean simply killing them off.

Pullets.—With the commencement of lay of the pullets the work of culling on actual production begins. The previous work done till now simply ensures that every pullet coming to maturity has the best chance the owner can give it of proving itself profitable.

Precocity.—Experiments ⁽¹⁾ have shown that the best laying birds mature early and that the birds putting on the worst records usually commence to lay late in their pullet year. Therefore, the age of maturity, that is when the pullet comes into lay, is of great importance and helps in good culling practice. The quickness of feathering over the back is a guide to the precocity of pullets. Environment and management have a good deal to do with this rate of maturity, but even so the best birds will invariably mature first.

All pullets of the Mediterranean class should commence to lay in 200 days from hatching, and pullets of the dual-purpose class—most English and American breeds—should commence in 260 days if the rearing management has been on correct lines. Pullets taking longer than this to mature are usually more profitable if sold before they have eaten any more feed. On the other hand very precocious pullets are abnormal or badly managed and will more often than not be lacking in constitution and lay small eggs, so should be culled in most cases.

At this point culling practice may be continued by either (1) trapnesting or (2) individual examination of external characteristics.

(1) **Trapnesting.**—This method of determining the actual record of a bird was first made use of, as far as we know, by the late Douglas Tancred in the U.S.A.

⁽¹⁾ Rice (1915), Goodale (1918), Kennard (1921), Hays and Bennett (1923), Buster (1924), Jull (1924), Kempster (1925).

The chief use of trapnesting is the selection of the best birds for pedigree breeding work, but to obtain the fullest use of them they should also be used on this type of poultry farm for culling the non-productive pullets. Any pullets not laying an average of 12 to 15 eggs during the first three months of laying will probably fail to score 150 eggs for the year, a number which is to-day reckoned the low limit for profit on the poultry farm where birds are fed on purchased feeds in semi-confinement. It will pay best to cull these pullets at the end of three months trapping, also any persistently laying abnormal eggs of any description. During the remainder of the year all birds that show signs of failing to reach the 150 egg standard for any reason should be sold off.

At the end of the year only birds having laid 150 marketable eggs or over should be kept for the following laying season.

This system is, of course, excellent, providing a true record and enabling the owner to dispose of his culls the moment they become unprofitable and spreading the sales throughout the year. It is excellent for the poultry man near a good market where he can dispose of several dressed culls per week, for he will realise much more for them in this way than by selling a large number all at once as live birds. It is, however, a somewhat expensive system compared to the second method. (For construction of trapnests see Bulletins 870 and 875, obtainable from the Department of Agriculture, Salisbury.)

(2) The method of culling by means of the examination of the external characteristics of the hen was first used by the late Walter Hogan in the U.S.A. in 1905. The system is much the same to-day and is often still called "Hoganising."

In later years experiments have shown the correlation between the different physical characters and annual egg production; some have been found to have no correlation however. The characters chiefly held worth while studying to-day are:

1. Pigmentation in yellow-skinned breeds.
2. Time of annual moult.
3. Capacity of abdomen.
4. Pliability of abdomen.
5. Width between pubic or pelvic bones.
6. Comb texture.

It will be noted that these are all physiological characters. The body measurements or morphological characters have shown less correlation with annual egg-production and, therefore, less emphasis should be placed upon them when using this method of culling.

(1) **Pigmentation.**—The yellow-skinned breeds possess a yellow pigmentation beneath the skin which is probably the most reliable single character for judging the production of a hen.

Palmer (1915) has shown that the presence or absence of this pigment in the fowl or its eggs is directly correlated with the presence or absence in the feed of a carotinoid pigment called xanthophyl. It is clear, therefore, that hens fed on a ration of feeds devoid of this pigment may be pale and have the appearance of having laid, though actually they may not have produced an egg. The character of the feed being fed, therefore, should be considered when culling by pigmentation. Feeds such as yellow maize and all green feeds are rich in this yellow pigment. When a pullet commences to lay this pigment from the feed passes directly to the ovary and the developing yolk. Gradually the pigment stored in the body is drawn upon as production continues and does not return until the bird ceases to lay.—Blakeslee and Warner (1915), Palmer and Kempster (1919). The pigment disappears from the body in the following order as laying progresses:—

1. The vent loses its pigment rapidly so that a white or pink vent indicates laying and a yellow vent that the bird has ceased to produce.
2. The eyering formed by the inner edges of the eyelids loses pigmentation a little more slowly than the vent.
3. The earlobe is the next to bleach out, by which time the bird will have been in production for 2—3 weeks.

4. The beak loses its pigmentation from the base first and the point last. The lower beak bleaches more rapidly than the upper one. A completely bleached beak indicates 4—6 weeks continuous production.

5. The shanks are the last to bleach because of slow circulation, commencing from the front and ending last of all at the back at the base of the hock. A bleached shank indicates continued production for about five months.

When a hen ceases to lay the pigment returns to the body in the same order in which it left. With a little thought, therefore, it is possible to tell fairly accurately the history of the last six months production of any yellow-skinned bird normally fed. For instance, pale shanks, yellow beak, yellow vent will indicate that the bird laid more or less continuously for five months, but has ceased to lay for about one month. Pale shanks, pale vent, pale tip to beak with a yellow band around the beak, will indicate five months production, a break of non-productiveness of short duration occurring 2—3 weeks ago, whilst the bird is now in production again.

(2) Time of annual moult is the next to be considered when the main culling is done at the end of the first laying year when the bird has been in production for twelve months. In this respect due regard must be paid to the time of hatching, as it is found that late hatched pullets moult later than early hatched pullets. With this in mind, however, it has been shown that pullets moulting late in the season are better producers than pullets moulting early in the season. To make this clearer, a pullet hatched in July, if she moults in November the following year, will be a lower egg-producer than a pullet hatched at the same time that does not moult until the following March, provided always that outside influences are not concerned. Further, an early moulter usually takes longer to renew her feathers than the late moulter who moults quickly and is often in production again before the early moulter, thus she is out of production for a much shorter period. Blakeslee, Harris, Warner and Kirkpatrick (1917), Van Rooyen (1932).

(3) Capacity as indicated by the distance from the tip of one pubic bone to the posterior point of the keel is an indica-

tion of annual egg-production. Normally the greater the distance the better the egg-production. Van Rooyen (1932).

(4) Pliability of abdomen is judged by feeling the skin of the abdomen between the fingers. The heavy producer has been shown to have a velvety skin and the whole abdomen soft and pliable, whereas the low producer has a thick, hard skin usually with a layer of hard fat beneath.—Van Rooyen (1932).

(5) Width between pubic bones in the good layer is great whilst in the poor layer the bones may be almost touching. This measurement and also that of capacity varies according to whether the bird being handled is actually in lay at the time or not, and due consideration must be allowed for this. The pubic bones themselves in the heavy layer are thin and tapering and pliable, whereas in the poor producer they are thick, blunt and stiff.—Sherwood (1922), Van Rooyen (1932).

(6) Comb texture is gauged by the smoothness or otherwise of the surfaces of the comb. The high producer when in lay has a large full smooth waxy comb and wattles, whereas the poor producer's head appendages are smaller, rougher and coarser.—Blakeslee, Harris, Warner and Kirkpatrick (1917), Van Rooyen (1932).

The correlation between these six characters and annual egg-production has been shown by investigators, but there are other minor characters which undoubtedly are also correlated in this way and are always found in the good producer—they may be summarised as follows:—

A bright prominent round eye; freedom of feathering round the face; tightness of feathering; the face clean cut and rather thin; strong well arched beak; the temperament is active, nervous and alert, yet the bird is friendly and easily handled, especially if trapnested; appetite seldom satisfied. A broad back and deep body are also desirable, though not essential, for the great layer.

General activity and vigour, of course, play a great part in the make up of the high producer. It must be clearly understood that when handling birds for culling using these principles due regard must be paid to age and breed of birds.

Also, it is essential that the operator should take into consideration all the characters as set forth and not cull a bird for failing in one or two respects. Judgment is required. Practice is essential before anyone can become really efficient, though it comes very easily. It is the duty of every poultryman to understand this work to the best of his ability, for to obtain the best results from his flock he must perform the operation himself when production indicates. He knows best how the birds have been managed and, therefore, is in the best position to cull them.

This main culling by means of examination of the external characters as enumerated should be carried out in mid December in order to get as many birds sold during the time when high prices are ruling and when early moulters have stopped laying. A later culling may take place in February or March, when the best birds are being selected for breeding purposes.

The best method of handling the birds is to drive them, a few at a time, from the laying house through a trap door into a catching crate. From the crate they are culled and placed in their respective pens. By this means the birds are not frightened and the operator can be working the whole time. A catching crate has sliding doors at each end and a hinged door on top for the removal of birds.

To cull, a right-handed person should grasp a bird in the crate by a wing close to the body, remove it carefully and then grasp the legs immediately above the hocks in the left hand between thumb and fingers, having the head towards the operator and the breast of the bird lying flat along the palm of the hand. In this attitude the bird may be turned in any position for examination and handled easily and correctly with the right hand.

If a flock of pullets is culled at the end of the first laying year, the remaining birds should pay to keep for the next year. At the end of the second laying season only those birds good enough to be classed as breeders should be kept for a further season, for production is highest during the first season and normally drops every succeeding year.

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THE WEATHER.

PART II.

(Contributed by the Meteorological Office).

GENERAL CIRCULATION OF THE ATMOSPHERE.

Maps showing the average pressure distribution, wind circulation, temperature and rainfall are reproduced in most atlases and elaborate charts of pressure and winds over the oceans are issued for the use of seamen. The intensive study of conditions over the oceans was carried out with the assistance of and for the benefit of ocean navigators; the development of aerial navigation calls for the production of similar charts over the land and in the upper air, and the data is being collected rapidly.

The general chart of the Southern Hemisphere shows a belt of high pressure round the latitude of 30° ; on the Equatorial side of this belt is a zone of south-easterly winds blowing towards the Equatorial low pressure girdle and on the Polar side a zone of north-westerly winds blowing towards the low pressure belt which extends beyond 60° latitude. At some point nearer the Pole it is believed that pressure rises again to form a Polar zone of high pressure, from which air flows out as a south-easterly wind. Except that the three great landmasses interrupt the belt of high pressure the general arrangement in the Southern Hemisphere is very symmetrical and general discussions of the atmosphere are invariably based on an idealised scheme derived from the observed conditions in this hemisphere. One of the most recent schemes is that of V. Bjerknes (On the Dynamics of the Circular Vortex with Applications to the Atmosphere and Atmospheric Vortex and Wave Motions). Adopting his description to the Southern Hemisphere, he shows a band of ascending air over the Equatorial zone and a confused zone of ascending air round about latitudes 50 to 60° , descending

air appears at latitude 30° (the sub-tropical high pressure belt) and over the Pole. The ascent of air over the Equator is due largely to convection and in the temperate zone occurs mainly in connection with the Polar front. The Equatorial zone of ascending air is fed mainly by the surface south-easterly winds which originate in the sub-tropical high, but part of the supply comes all the way from the Pole; the air, after descending, moves towards the Pole as a north-westerly wind, the greater part descending in the sub-tropical high, some returning to the Equator in the south-east winds and some continuing towards the Pole as a north-west wind, the remainder of the air continues at a high level to the Polar high pressure, where it descends and forms the Polar south-east wind. This would form a complete circulation in itself, the air delivered from the Equator to the Pole at a high level returning to the Equator as a cold wave along the surface, but there is one important additional circulation which probably predominates in the temperate zone, and that is the surface north-westerly which originates in the sub-tropical high, ascends at the Polar front, and returns as an upper current to feed the sub-tropical high.

If this scheme gives a true picture of conditions then the prevailing winds between 30° and the Equator for a depth of several kilometres should be between south-east and east with a corresponding west to north-west wind above extending to the tropopause; in the temperate zone north-west winds should alternate with south-east on the surface, the former predominating and a reversed system should prevail above. The circulation over the Pole should be similar to that over the Equator.

An ideal circulation such as the foregoing must be modified considerably by the unequal distribution of land and sea. Sea temperatures are comparatively steady while the land surface becomes very warm in summer and cold in winter. In general pressure is high over the land in winter and low in summer and the air circulation is modified accordingly. The outstanding modification due to the effect of a land mass is the seasonal change over the continent of Asia, which is covered by an enormous area of high pressure (anticyclone) in the northern winter and an equally enormous

area of low pressure (cyclone) in the summer. This great change in pressure distribution is associated with a corresponding variation in the winds. During the winter India is traversed by north-west winds which originate in the anti-cyclone and sweep across the Arabian Sea to the coast of Africa; it is probable that these winds extend as far as Southern Rhodesia at times. During the summer the south-east winds originating in the South Indian Ocean high cross the Equator and sweep over the Indian Peninsula as the "South West Monsoon" on their way to the low pressure area in Asia. In this case a complete reversal occurs between summer and winter and the ideal circulation does not appear. All land masses exercise modifying influences on the circulation, and the ideal circulation, if it exists, is most likely to be found in the vast oceans of the Southern Hemisphere, for which the necessary observations are at present lacking.

The island of Mauritius lies about 8° east of Madagascar and nearly 20° east of the South African land mass; an examination of the upper wind data kindly supplied by the Director of the Royal Alfred Observatory shows that the winds are very similar to those observed at Salisbury, the prevailing winds in the lowest layers are easterly with a small component from the south which changes to north in the summer months; at a height of 2 km. in winter rising to 7 km. in summer the direction changes from east to west, but the slight component from the south remains up to at least 8 km. At Salisbury the change from east to west takes place at much greater altitudes, the west wind is not established until 5 km. above sea level is reached in winter and approximately 10 km. in summer; the slight southerly component is generally present.

GENERAL CIRCULATION OVER SOUTHERN AFRICA.

The results of pilot balloon observations at a large number of stations in the Union of South Africa have been published and are available; in Southern Rhodesia results are available for Salisbury and Bulawayo, and the results of individual observations over one year are available for Zanzibar, Nairobi and Kampala. The three latter will be referred to as the tropical stations.

The winter circulation at 2 km. above sea level appears to be about an anticyclone off the east coast with its axis in latitude 25° : at 3 km. the centre of the anticyclone appears to lie over the Bechuanaland Protectorate and the centre moves steadily north until at 6 km. the axis must lie north of 15° latitude, all the winds at stations to the south of this showing consistent moderate west-south-west to westerly winds. The Equatorial stations show east-south-east winds up to 3 km. and then swing to north-east and remain there up to 6 km.

In the summer months the circulation at 2 km. is not very different from winter, the axis of the high appears to lie a few degrees further south and the Southern Rhodesian winds have a northerly component, again at 3 km. there is little difference between summer and winter but the circulation up to 6 km. in summer continues round an anticyclone centred in Bechuanaland and South-West Africa and westerly winds do not in general appear north of latitude 25° . Winds at the Equatorial stations are north-east up to 4 km. and then become easterly with a slight component from the south.

The appearance of westerly winds at increasing heights as the Equator is approached during the winter from sea-level at the Cape to 5 km. over Salisbury conforms to the usual theoretical scheme of wind distribution, this westerly air being the descending air from the Equatorial convection belt which is on its way to the surface in the sub-tropical high pressure belt. It is noteworthy, however, that very nearly all the mean winds at all stations, including Mauritius, have a slight component from south to north above 3 km., that is, from the Pole to the Equator and not as one would expect from the Equator to the Pole, whereas in the lower levels the majority of mean winds show a considerable component from north to south, that is, from the Equator towards the Pole; examination of the sparse observations at greater heights indicates that the Equatorward motion extends up to at least 12 km. Pilot balloon observations are of necessity limited to comparatively clear weather, and there is therefore a possibility that the records are not representative of all conditions, a comparison of the Bulawayo pilot balloon records with observations of cloud movement fails to indicate any

appreciable difference in the results, and failing definite information to the contrary the indications of the pilot balloons must be accepted as reasonably representative.

Seasonal Variation of Wind.—In a country with a marked wet and dry season it is reasonable to expect that the prevailing winds should show an equally marked variation, actually at both Salisbury and Bulawayo the mean surface winds show a small swing towards the north in summer and towards the south in winter, the amount of the swing is less than 10° and can hardly be significant. The upper winds in the lower layers show small differences and it is not until the height of the winter westerlies, 4-5 km., is reached that a marked change between winter and summer conditions appears. The presence of a deep band of westerly air in winter may be a contributory cause of the absence of rain but can hardly be responsible for the great variation of humidity which occurs on the surface. The only other marked change in the general circulation between winter and summer is the swing of the wind in the Equatorial area from east-south-east to north-east in the lower levels and from north-east to east-south-east above; this change is probably related to the weather sequence in the south but no clear connection can be established at present.

It is evident that local mean wind directions throw no light on the seasonal changes. An examination of frequencies, that is, number of occasions on which wind from different directions is recorded indicates that there is unquestionably an appreciable increase in the frequency of winds between north-east and north-west in summer amounting to from 10 to 20% of the number of observations and it appears likely that this may be significant.

The Daily Weather Map.—The daily weather charts of South Africa show a movement from west to east of a succession of waves of high and low pressure. The movements are far from regular, but there are roughly four to five waves per month. As the low pressure approaches the Cape the winds swing to north and north-west and become warm, as the trough passes over the country moderate to strong cool south to south-east winds replace the northerlies and rain frequently occurs, as the ridge of high pressure passes the

winds fall light and swing to east. It appears probable that the cool southerly winds undercut and raise the warmer northerlies and the weather experienced depends on the humidity and temperature difference of the two air masses and on the violence of the change.

The paths traversed by the high and low pressure systems are far from regular. In winter the highs usually appear about the latitude of Port Nolloth and move round the south coast and up the east coast, leaving a centre of high pressure over the Transvaal. More rarely the movement is across the land. As the centre of high pressure reaches Durban the next low makes its appearance off the south-west coast and moves to the east on a more southerly course than the highs, usually disappearing off Durban towards the east. On rare occasions these southerly lows move inland and may even traverse Southern Rhodesia. As a general rule the winter highs appear to be in complete control of the situation and may remain spread over the greater part of South Africa for weeks, receiving periodical reinforcement from travelling highs moving along the south coast. Under the conditions light easterly winds extend over the whole of Southern Rhodesia with bright sunny days and cool nights; when the semi-permanent high is broken up and the lows affect the country, more northerly winds and warmer days are experienced and the succeeding incoming high brings moderate to strong cold south-easterly winds lasting from one to three days.

In summer the paths of the lows and highs lie farther to the south, the highs appear either on the south-west or south-east Cape and move up the east coast, the centres usually remaining off the coast, the southerly lows are well to the south and appear to play a minor part in the weather sequence. A low pressure system, the Equatorial low, of uncertain dimensions, develops over the Kalahari area and plays a very large part in the events of the summer season. From time to time this low deepens and extends to the south-west coast and its more southerly portions swings to the east as a trough of low pressure which frequently traverses Southern Rhodesia from south to north. The succession of events as the trough passes is, hot north-west winds followed by cool south-east winds, and the weather depends on the intensity

of the change. The two or three hot days in October or November with northerly winds followed by thunderstorms and cool south-east winds are typical of the passage of these troughs. If the extension and movement of the Equatorial low is accompanied by an extension towards Southern Rhodesia, indicated by a marked fall of pressure in the Livingstone-Wakie area, it is likely that a period of rainy weather will set in.

The South Indian Ocean cyclones appear during the summer months, as a general rule these storms approach from the north-east and curve towards the south and then south-east, the whole path being to the east of Madagascar and the storms having no effect on the mainland; occasionally the track lies well to the west and passes down the Mocambique Channel. This movement appears to interrupt the normal circulation and has a marked effect on the weather. The actual formation of cyclones in the Channel itself has been observed on a number of occasions. Fortunately cyclones appear to be unable to traverse large land masses, and Southern Rhodesia has not experienced the full force of these storms.

Illustrative Charts.—A few charts have been reproduced to illustrate important sequences or interesting events. It is unfortunately impossible, on account of expense, to cover all the various movements which have been described.

Onset of Rain.—The charts of the period 30th and 31st January and 1st February, 1931, are a good example of the onset of rain. These charts show, in addition to isobars and winds, crosses at the stations where rain was recorded during the succeeding 24 hours and the absolute humidity at the surface at the time of observation reduced to isobar level. 55° etc.

The first chart shows a weak high with its centre to the south-east of Southern Rhodesia and low pressure along the west coast; the winds in Rhodesia are easterly to north-easterly and the air is dry for the time of the year; the dewpoint over an area in Northern Rhodesia is above 60° and in the south-west of Southern Rhodesia is below 55°. A few stations reported rain in the succeeding 24 hours, but the average over the country was negligible.

On the 31st the high had weakened and a trough of low pressure extended through the Kalahari with low pressure on the south coast. The winds remained easterly on the whole, but the area of high dewpoint had extended well into the western part of the country. The rain followed the wet air with remarkable fidelity; the average rainfall over the western part of the country amounted to 0.25 inches.

On the 1st the low was completely in control and the winds were generally from the north. Practically the whole of Southern Rhodesia had been invaded by wet air, and rain was fairly general, averaging 0.72 inches over the whole country. The light north-west wind at Bulawayo is typical and is frequently the forerunner of a squall. This example illustrates both the "northerly current" theory and the "dewpoint" theory very well, but is, unfortunately, of comparatively rare occurrence.

Fair Weather.—The chart for the 21st of November, 1931, was the prelude to ten days' fair weather. Fairly general rain occurred from the 6th to the 15th, and showers continued for some days. A high appeared on the 19th and was established near Lourenco Marques on the 21st. Showers fell on the 20th and 21st, and the weather then cleared and remained fair to the end of the month. The resulting weather seems to depend to a large extent on the relative positions of the high and low; the high of the 21st November bears a close resemblance to that of the 30th January, but the low is much further advanced and will pass off without materially affecting the high.

Rain.—The chart of the 15th January, 1932, shows conditions favourable for a period of rain. Rain began on the 14th and actually persisted until the end of the month. The whole of South Africa is covered by a deep low, and there is no indication of a following high, the inference is therefore that northerly winds will persist for some days and that rain will continue. This type of pressure distribution is most common in the rainy season proper, and the rain usually continues throughout the fall in pressure and for some days during the succeeding rise.

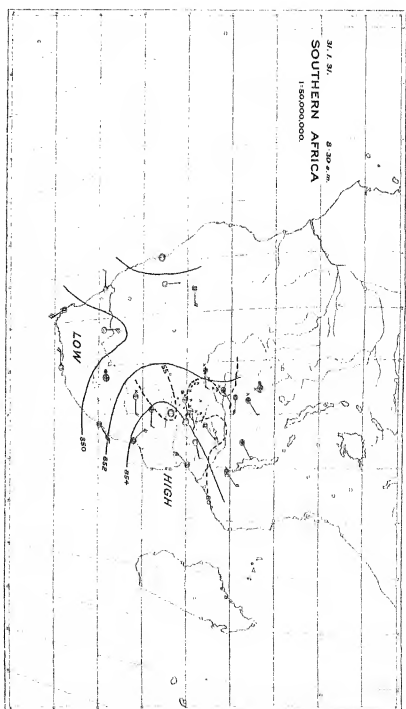
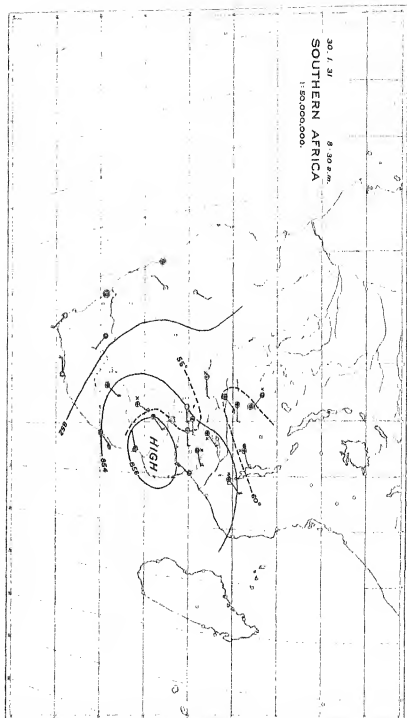
The chart for the 3rd March, 1932, shows a high moving well off the east coast, a condition in itself favourable for

rain, and a well developed low in the west which may be expected to move down to the south coast, when conditions similar to those of the 15th January may appear. Actually the chart of the 8th March bore a close resemblance to that of the 15th January, and rain continued for a considerable period.

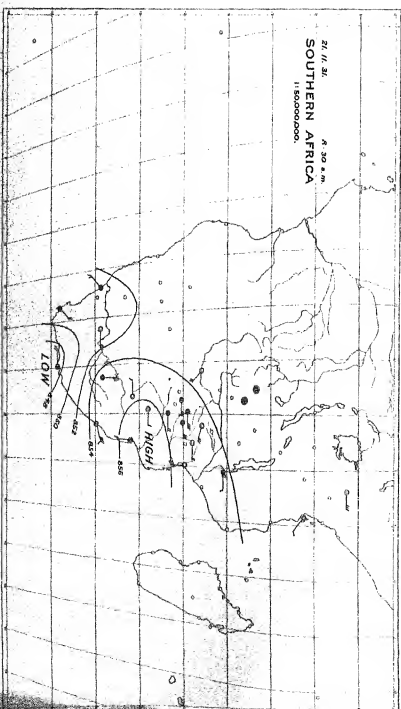
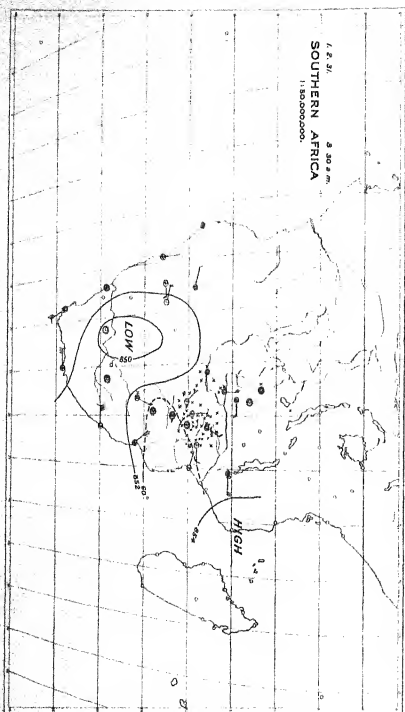
East Coast Lows.—The appearance of an Equatorial low on the east coast was first detected in January, 1925; it remained in position for four days and was associated with torrential rain in the north-eastern part of the Colony. In 1929 a cyclone of small dimensions suddenly appeared at Beira; this cyclone seems to have traversed Southern Rhodesia from east to west and then returned to the coast. Destructive effects were observed in the low country between the coast and the eastern border mountains and very high winds at Umtali and Melsetter, but from there the effects were those of an ordinary low and fairly heavy rain was experienced during its presence.

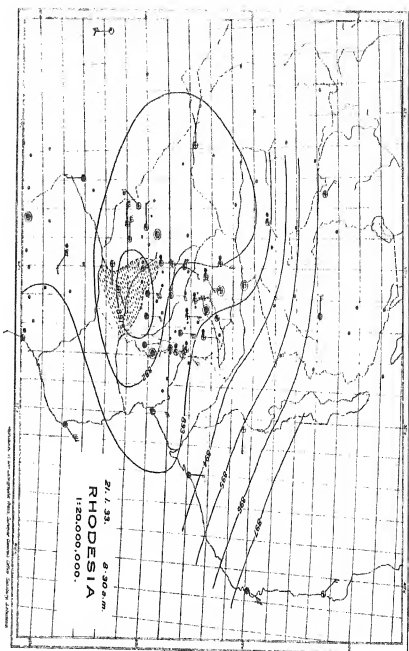
It is also fairly well established that the presence of low pressure systems in the east, particularly in the Mocambique Channel, is unfavourable for rain in the Colony; the normal track of the Indian Ocean cyclone lies to the east of Madagascar, and when it recurves in the ordinary way it has little effect on the weather in South Africa. Occasionally cyclones penetrate to the Mocambique Channel, and in February, 1933, the Equatorial low itself appeared to take up a position on the west coast of Madagascar for a period of at least a month with disastrous results to the rainfall of the colony.

The season 1933/34 introduced a new hazard. Towards the end of December lows commenced to appear from the north-east corner of Madagascar traversing a track parallel to that of the normal cyclone but on a westerly orbit, affecting the east coast of Africa from Mossuril to Durban. These lows appeared at frequent intervals and dominated the charts for two months. Their general effect is unfavourable for rain in the Colony, but there is the ever-present danger of a movement inland. Northerly lows are very erratic in their movements, and one of them chose to swing in on the 6th January,

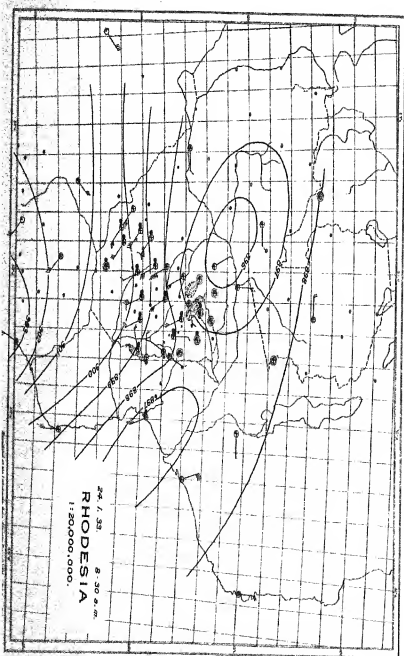
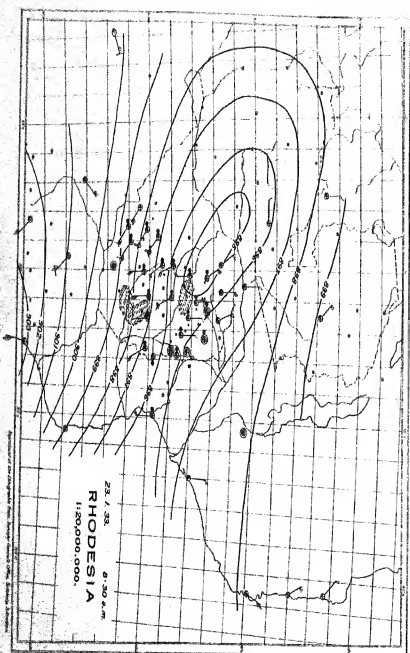
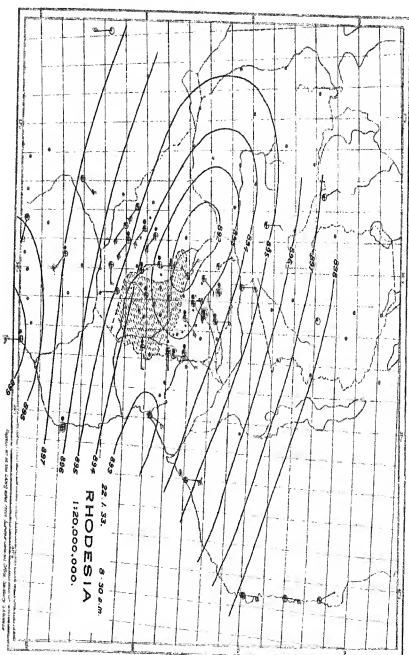


ISOBARs at 1500 m.





ISOBARS at 1,000 dyn. m.



1934, over the eastern border and a very heavy rainfall resulted. Area 7, about 14 per cent. of the total area of the country, averaged 2.33 inches of rain in 24 hours.

Two charts have been selected to illustrate these lows. On the 22nd February the centre lay between Mossuril and Quellimane was not very deep; very little movement was apparent on the 23rd, but the pressure fell about 5 mb. at Mossuril and about 4 mb. at Quellimane; winds in Southern Rhodesia were south-easterly in the east and easterly in the west, and dewpoints were low. One or two showers were recorded on the 22nd and no rain on the 23rd. On the 24th the low had moved definitely to the south, and the pressure conditions in Southern Rhodesia were complex, but generally pressure was very low and the dewpoints were low. Light rain was recorded in the afternoon in the west and south and continued for some days as the pressure rose, but the amount was trifling.

Dry Air.—The chart of the 10th March, 1931, illustrates an ideal clear up. A high with cold air in its forefront was approaching Southern Rhodesia from the south, and on the morning of the 10th had reached a line running from south of Bulawayo to north of Umtali, and is shown on the chart as a cold front. Moderate south-easterly winds are blowing south of this line and a number of stations are reporting rain. In front of the cold air for a distance of 60 miles the winds have turned, and further away they are blowing in towards the cold air. Behind the cold air at varying distances a sudden drop in humidity appeared, and a close investigation of the available data, including autographic charts, showed that the cold air traversed the country at approximately 15 miles per hour, and that the rain fell at nearly all stations. The whole of the manuscript returns for Northern Rhodesia for the season had been lent to the office by Mr. Fairweather, and an inspection showed that the dry air could be traced right through the country to Abercorn, where it arrived on the 13th. The solid lines with times and dates indicate its approximate position from day to day. The weather cleared with the arrival of the dry air and a spell of fair weather set in.

Thunder Squall.—The general chart for the 8th March, 1933, showed a deep low near Bloemfontein, and under normal circumstances the chart for the 9th would have been expected to show a trough of low pressure to the south of Southern Rhodesia, and the passage of the squall would probably have occurred during the 9th and 10th. Actually the squall moved with phenomenal rapidity. It approached Bulawayo shortly after 10 p.m. and was at Fort Victoria at 1 a.m., Que Que at about 4 a.m. and passed Salisbury at 7 a.m. Marked irregularities occurred in the barograph traces at Bulawayo and Fort Victoria, and at Salisbury the pressure rose 1 mb. abruptly and a further 2 mbs. in a few minutes. The arrival of the squall was observed at Salisbury; it appeared as a long line of misty cumulo-nimbus approaching rapidly from the S.S.W., and a well developed squall cloud was seen as it approached; thunder and lightning were observed and heavy rain fell. The squall was traced on the autographic instruments as far as Bindura at 9 a.m., but no rain occurred after 10 a.m. The position of the squall at various times is indicated by the dotted lines. The isobars appear to suggest that the rain was responsible for raising the pressure over 2 mbs. over an area of some thousands of square miles.

Continuous Rain.—The general chart for the 18th January, 1933, showed a low similar to that of the 15th January, 1932; on the 19th the main low had disappeared and a shallow low remained over the Transvaal; this depression deepened on the 20th and on the 21st the centre was definitely in Southern Rhodesia. The four charts show the slow movement of the low to the north-west and its gradual filling up. The rainfall at about 500 stations was plotted, and all the stations within the cross-hatched areas received 2 inches or more of rain in the 24 hours succeeding the epoch of the chart. The rain in the south-eastern portion of the country was remarkably heavy and continuous, the maximum reported was 18 inches in four days and on the 22nd an area approximately 100 miles square recorded over 4 inches. The heavy rain was largely confined to the south-eastern quadrant of the low; this is in agreement with past experience in 1924/25 when the Equatorial low made frequent excursions into the country.

Detailed Weather Charts at 1,000 gdm.—Two charts have been selected to illustrate the weather maps at present in use. That of the 9th November, 1933, shows conditions precedent to a complete change in the weather. On the 8th the remnants of a weak high lay over Southern Rhodesia, very little cloud was reported, winds were light, and dewpoints, particularly in the south, were very low. A trough of low pressure was approaching from the south, and on the morning of the 9th a general swing of the wind occurred, the trough traversed the country during the succeeding 24 hours and heavy rain was fairly general, amounting to 0.53 inches over the whole country.

The chart of the 24th November indicates the complications of the isobars encountered with a sufficient number of observations. A high is approaching from the south-east and appears to have penetrated to Salisbury, although the winds are not in good agreement. It is probable that the extreme tip of the high is due to the thunderstorms in the area, and that the general position is a trough of low pressure running from north-east to south-west between the high approaching from the south-east and the residue of a high in the north-west. Well marked convergence is shown in the troughs to the south-west and to the north-east, but some of the winds are inexplicable on the pressure distribution, and the rain at the time of observation appears to be concentrated rather along the axis of high pressure; this is commonly the case, and it is possible that the rain influences the pressure generally. During the succeeding 24 hours rain was recorded at most stations, but was heaviest in the areas covered by the troughs of low pressure on the chart.

LOCAL FORECASTING.

Official forecasts are made and distributed to a number of centres during the rainy season. In the absence of a regular radio broadcast service the standard forecast which covers a period of 24 hours only is of little value and official forecasts are intended to cover from two to three days, the extension in time has only been possible by generalising the terms of the forecast, and from the point of view of the individual a forecast which is true over three days may not suffice for special

operations; further, the value of the forecast is greatly enhanced when the user is versed in local weather lore and can interpret and recognise the appearance of anticipated changes. The following is a short summary of useful tips which can be applied at a single observation point.

Persistence of the Weather.—It has been demonstrated from past records that rain days and fine days do not occur according to the laws of chance, the distribution shows a distinct tendency to persistence. There is slightly more than an even chance that a single fine day or rain day will be followed by another of the same kind, and after three successive days of fine or rain the chances of the next being the same are rather better than three to one; if therefore rain or fine has persisted for three days or more it may be expected to continue unless marked changes put in an appearance.

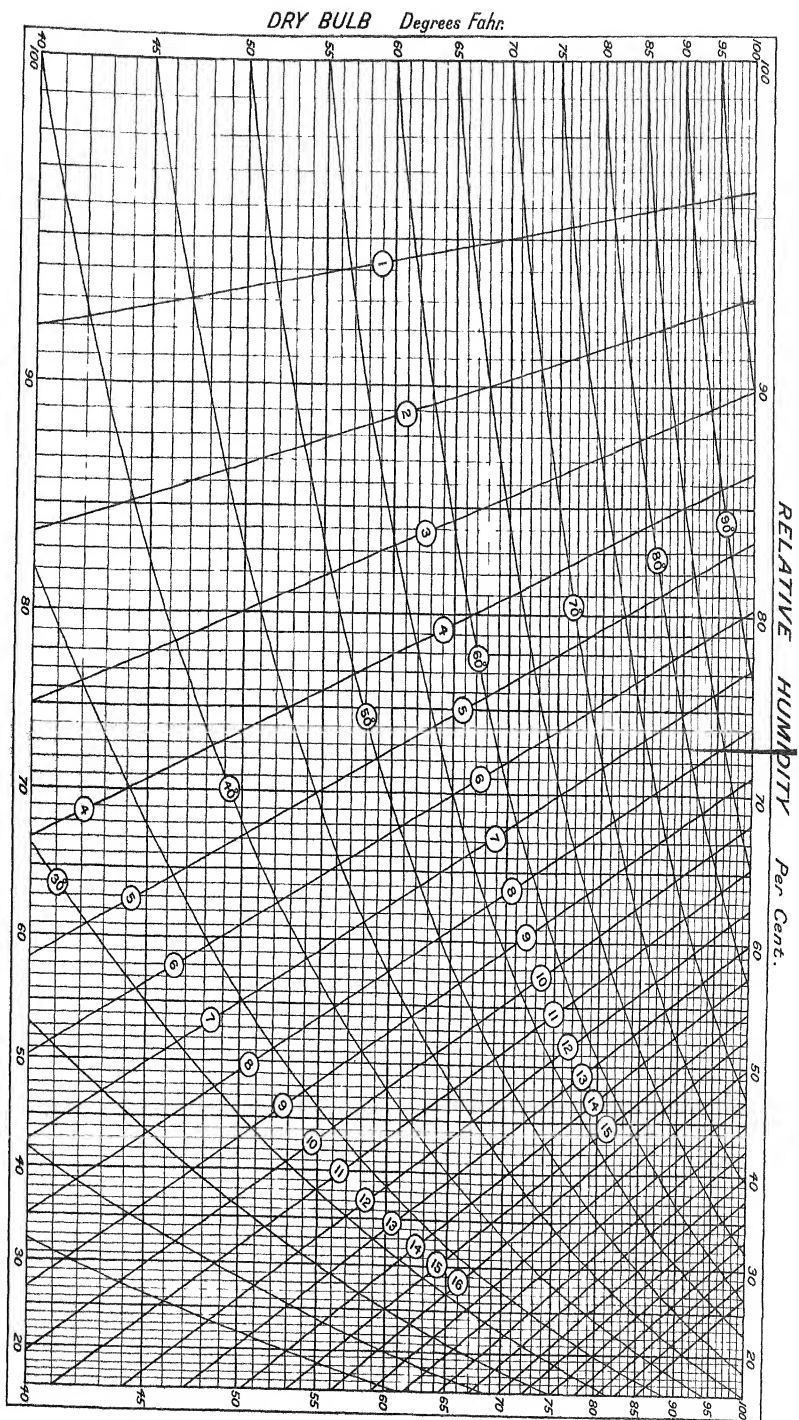
Moisture in the Air.—Measurements of the moisture content of the air may be obtained from the readings of the dry and wet bulb thermometers used in tobacco curing. The instrument should be used out of doors in a position where it is exposed to the wind but shielded from the direct rays of the sun or from strong radiation from sunlit ground, the inside of a pillar supporting a thatched verandah facing south or north gives a fair exposure or a special small thatched shelter erected over grass in the garden would serve.

Any defect in the instrument is likely to lead to high readings of the wet bulb, and it is important that the muslin and wick used should be clean and free from grease and that pure water only should be used. Rain water is most suitable, but if river or well water must be used it should be boiled and both the water and the muslin and wick changed frequently.

The dry and wet bulb thermometers should be read regularly, preferably between the hours of 7 and 9 a.m., to the nearest degree. The humidity is obtained from the chart reproduced in this article as follows:—

- (1) Subtract the wet bulb temperature from the dry.
- (2) Find the horizontal line representing the dry bulb temperature to the nearest degree.

CHART OF RELATIVE HUMIDITY AND DEW POINT.



- (3) Find the point where this line is crossed by the oblique straight line representing the difference of the wet and dry, the lines are numbered in circles 1, 2, 3, etc., from left to right.
- (4) The vertical line through this point gives the relative humidity in per cent.
- (5) The curved sloping lines indicate the dewpoint in degrees and are drawn for every 5° and numbered every 10° . The dewpoint is estimated from the position of the point found in (3) in relation to these lines.

Example.—Dry bulb 65° , wet 57° , difference 8° ; the difference line for 8° cuts the line for 65° on the vertical line representing 61% relative humidity. The point lies between dewpoint lines 50° and 55° and nearer the former; by estimation the dewpoint is 51° .

It has been proved in Salisbury that during the period 1st December to 31st March the probability of rain on any day is closely connected with the dewpoint measured in the morning, the chances are as follows:—

Dewpoint below 56°	Chance of rain very small.
„ $56 - 57^{\circ}$	„ „ one in three.
„ $58 - 59^{\circ}$	„ „ one in two.
„ $60 - 61^{\circ}$	„ „ two in three.
„ 62° or above	„ „ four in five.

When the dewpoint is 60° or above the chances of rain are 3 in 4, and when it is below 60° the chance is only 1 in 3.

The rule may be applied to almost any place in Southern Rhodesia during the four months December to March, but allowance must be made for height, for every thousand feet above Salisbury 3° must be added to the dewpoint and for every thousand feet below Salisbury 3° must be subtracted from the dewpoint before the above table of chances can be used. Taking Salisbury as 4,900 feet, if the observations are made at 3,200 feet, that is 1,700 feet below Salisbury, then the dewpoints should be reduced by 5° . The early and late rains usually occur with lower dewpoints and only last for a day or two.

Wind and the Barometer.—The following extract from Bulletin No. 524 sets out the use of an aneroid barometer:—

The commonest use of the aneroid barometer in England is as a "weather glass," and the commercial aneroid therefore usually has divisions on the dial marked "stormy," "rain," "change," "fair," which approximate fairly closely to the pressure conditions which prevail prior to these weather changes at the place of manufacture of the instrument, but are quite unreliable elsewhere. These weather characteristics usually occupy the following overlapping divisions on an aneroid dial: Stormy, 29.2 ins. to 29.7 ins. Rain, 29.4 ins. to 29.9 ins. Change, 29.7 ins. to 30.1 ins. Fair, over 29.9 ins. Very dry, over 30.1 ins.

When an aneroid is brought to this country it will be found, of course, that the needle will not be registering anywhere near these divisions, but will probably be somewhere between the 25 and 27 in. marks. This is owing to the altitude of the locality, as the aneroid will approximately register 1 in. less than the normal for every 1,000 feet rise in altitude above sea-level. This could be easily corrected by shifting the needle, but it will be found also that the magnitude of the fluctuations experienced here from day to day in no way approaches the range of the fluctuation covered by these weather divisions. The range from the bottom of the "stormy" division to the commencement of the "change" division is 0.5 in., and 0.7 in. to the commencement of the "fair" division. It will be found, however, that in this country the range of the barometer seldom exceeds more than .25 in. during the wet season, and the difference between the highest barometer reading in the winter and the lowest barometer reading in the summer is seldom more than 0.5 in. In effect this means that the needle would register in the same division throughout the wet season, and apart from any other consideration the words printed on the dial must be reckoned as useless for any practical purposes. It was pointed out, however, in the article on "Weather Types Affecting Rhodesia" in the June issue of the *Rhodesia Agricultural Journal* that the aneroid barometer could be utilised as a rough indicator of probable local weather if it were read at a fixed hour each morning and the readings plotted on squared paper in order to magnify greatly the scale of the fluctuations.

The following general principles, which are useful indications of probable weather, although by no means infallible, are reprinted from the article mentioned:—

(1) *During Early Rain Period.*—When the pressure has been falling steadily for three days, accompanied by prevailing northerly winds, rain is probable within the next two days with rising pressure.

(2) *During General Rain Period.*—When rain commences with a comparatively high pressure, which is, however, on the down grade, the rain period is likely to continue for several days unless a very marked 24-hour pressure rise should occur, which would indicate the end of the rain period on the following day. If, in addition, the wind veers steadily in a counter-clockwise direction from north-east through north to westerly directions, then conditions are still more favourable for rain.

(3) When low pressure is prevailing, if the wind suddenly changes from a northerly to a southerly direction, rain may occur on the day of the change, but fine weather is likely to follow. Persistent winds from a southerly quarter are not usually favourable for rain.

In connection with the use of the term “falling pressure,” it should be noted that this only refers to the pressure taken at a fixed hour on consecutive mornings, preferably at 9 a.m., when the pressure is normally at its highest for the day. What is known as the “diurnal fluctuation” of the pressure is most marked in this country, *i.e.*, the pressure will normally fall steadily throughout the day to a minimum at 4 to 5 p.m., and then rise again to the morning maximum at 9 to 10 a.m. This diurnal fluctuation is therefore no indication of the trend of the pressure unless an abnormally large fall occurs during the day, when it is usually an indication of a lower pressure next morning.

The following table shows the normal diurnal fluctuation of the barometer at Salisbury at various hours of the day in decimals of an inch, as compared to the 9 a.m. reading for the months in which this fluctuation is at a minimum and a maximum, *viz.*, in July and October. It emphasises, however,

the need for these barometric readings to be taken at a fixed hour if any comparison is to be made from the readings as to the trend of the pressure:—

A.M.						P.M.					
1	3	5	7	9	11	1	3	5	7	9	11
JULY.											
—041	—044	—044	—033	nil	—002	—031	—057	—060	—055	—044	—040
OCTOBER.											
—056	—060	—056	—034	nil	—007	—049	—083	—090	—080	—061	—053

The normal diurnal fluctuation during the months of the ordinary wet season is very similar to that given above for October, so it will be evident from the above figures that a fall of under 0.1 in. during the day is no indication of a probable lower pressure next morning. It will be noticed also that during the period 9 to 11 a.m. the pressure is very steady. This will be referred to later in connection with the use of an aneroid for altitude observations.

Frost.—Frost has been recorded in the farming areas of Southern Rhodesia in all months between April and December. Conditions favourable to its occurrence usually appear after the invasion of high pressure as soon as the cold south-east winds cease.

The dewpoints determined from the readings of the wet and dry bulb thermometers may be used for anticipating frost. The dewpoint determined in the late afternoon will give a fair indication of the lowest temperatures likely to be reached during the night on flat open stretches of ground; in sheltered valleys the minimum temperature may fall as much as ten degrees below the dewpoint and readings of 40° or less should be taken as a danger sign.

Southern Rhodesia Veterinary Report.

DECEMBER, 1934.

AFRICAN COAST FEVER.

Charter District.—Five cases occurred at the Greyling centre and nine at the Riversdale centre.

FOOT AND MOUTH DISEASE.

Salisbury District.—The disease was diagnosed on a farm near Salisbury and on investigation was found to exist on the Commonage and three other farms. The infection was traced to one lot of cattle removed from the Victoria district.

Victoria District.—Extensions occurred in the Ndanga and Victoria native districts.

TRYPANOSOMIASIS.

Two cases in the Wankie district.

TUBERCULIN TEST.

Nineteen cattle were tested on importation; no reaction.

MALLEIN TEST.

Twenty-eight horses, 25 mules and 35 donkeys were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate.—Cows and heifers 16, bulls 3, horses 28, mules 25, donkeys 54, sheep and goats 1,535, pigs 30.

EXPORTATIONS.

To the United Kingdom *via* Union Ports in Cold Storage.—Chilled: Beef quarters, 2,971. Frozen: Boned quarters, 138; pigs carcasses, 112; tongues, 9,631 lbs.; livers, 8,995 lbs.; tails, 2,278 lbs.; skirts, 4,279 lbs.

Meat Products.—From Liebig's Factory: Meat meal, 25,000 lbs.; hoofs, 10,983 lbs.; tallow, 27,147 lbs.; Neat's foot oil, 5,680 lbs.

From Rhodesian Export and Cold Storage Company.—Beef fat, 14,825 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 26. January, 1935.

During January the locust position has shown progressive improvement, and at the end of the month it can be stated definitely that the Colony has been saved through natural agencies from what threatened to be a phenomenal hopper outbreak

Not only have the hatchings on the whole been infinitely lighter and more limited in distribution than the distribution of egg-laden winged locusts, or even reports of egg-laying indicated, but *Empusa grylli* has quickly appeared amongst the hoppers in the more humid districts and has apparently been responsible for very heavy mortality.

At the end of the month there remain only two districts, namely, Wankie and Nyahandhlovu, both adjacent to the western border, where, according to report, the position is at all serious.

Red Locust (*Nomadacris septemfasciata* Serv.)—Practically all specimens received at Salisbury have belonged to this species.

The hopper stage has been mainly in evidence and very few swarms of fliers were reported up to the middle of the month. It is, however, to be noted that the weather was extremely wet and largely overcast, tending to depress activity. Comparative absence of winged swarms does not necessarily imply similar absence of scattered individuals, and there were abundant indications of disintegration of the winged swarms in December.

About the 19th a recrudescence of invasion commenced, large and healthy winged swarms being reported to be coming in from North Bechuanaland flying in a westerly direction,

the districts most involved being Wankie, Nyamandhlovu and Bualima-Mangwe. These incoming swarms were in egg-laying condition and are reported to have laid eggs freely in several districts. Egg-laying has also been reported during the month in several localities in the Mazoe district and in Ndanga, Gutu, Makoni and Bulawayo districts.

Tropical Migratory Locust (*Locusta m. migratoria*).—The only record of this species during the month was the unexpected discovery of a swarm of fifth-stage hoppers and newly matured adults in the Hartley district on the 3rd. The early layings by this species seem generally to have failed, and heavy hatchings anticipated in the Wankie district and the Zambesi Valley, in the Lomagundi district, have failed to materialise.

Brown Locust (*Locusta pardalina*).—On the 25th of the month advice was received from the Union Department of Agriculture to the effect that swarms of this species were flying in Northern Bechuanaland and that some were close to the Rhodesian border. No swarms of the Brown Locust have, however, been reported as yet within the Colony. It would appear that the Colony is in danger of invasion by this species during the coming dry season, although this will depend upon the success or otherwise of the next generation in Bechuanaland.

Enemies and Disease.—The White-bellied Stork (*Abdimia abdimii*) has been very abundant, and has been reported as attacking the hoppers in certain districts. The White Stork (*Ciconia alba*) has also been reported, although it has not been much in evidence around Salisbury.

There have been several verbal reports of parasites, possibly *Blæxoripha* sp. in adult locusts.

Almost all egg deposits seem to have been attacked in a varying degree by *Stomatorhina*.

The locust fungus (*Empusa grylli*) has attacked hoppers freely in the second stage. The major portion of the Colony seems now to be thoroughly infected with this disease and,

unless abnormally dry weather supervenes, it is difficult to foresee extensive survival to the adult stage, except perhaps in the western districts.

Outlook.—The outlook for the present and next season is very encouraging as far as the Red Locust is concerned, but, as already stated, trouble may be experienced with the Brown Locust, and the Tropical Migratory Locust is an unknown quantity.

It is to be realised, however, that in the course of the previous swarm cycle the Red Locust remained in South Africa for a large number of years, notwithstanding the presence of *Empusa*, and that it demonstrated its capacity for recrudescence after being reduced to small numbers by natural agencies. The cycle may now die down altogether or an uncertain period of years may witness outbreaks of varying intensity.

RUPERT W. JACK,
Chief Entomologist.

Schedule of Rainfall for Week ending 26th February, 1935.

	Total for week.	Total since Oct. 1st.	Normal to date.
Beitbridge... ..	Nil	5.66	9.91
Bulawayo... ..	0.03	20.27	18.65
Essexvale... ..	0.03	23.80	20.09
Fort Rixon	Nil	18.03	18.24
Gwanda	0.14	9.70	16.48
Inyati... ..	Nil	24.72	20.01
Matopos... ..	Nil	19.93	19.24
Nyamandhlovu	Nil	19.76	17.67
Bikita... ..	2.42	42.44	25.29
Gutu... ..	0.71	30.73	22.77
Shabani	0.14	16.16	16.95
Fort Victoria	0.42	15.92	20.31
Chipinga... ..	2.99	31.89	30.41
Melsetter... ..	2.80	36.04	—
Enkeldoorn	0.11	29.34	24.01
Gwelo	0.16	29.38	21.32
Hunters Road... ..	0.13	29.38	22.75
Mtao	0.43	21.96	22.33
Que Que	Nil	23.86	22.86
Selukwe	0.88	51.26	30.83
Plumtree	Nil	14.99	19.03
Wankie	Nil	20.62	19.44
Beatrice	0.11	26.83	25.48
Gatooma	0.12	25.63	25.13
Hartley... ..	0.08	30.63	25.40
Makwiro	Nil	27.59	25.75
Headlands	0.41	38.41	28.49
Inyanga	0.43	38.33	29.49

	Total for week.	Total since Oct. 1st.	Normal to date.
Inyazura	0.68	30.26	26.97
Macheke	0.24	31.49	27.16
Marandellas	0.36	35.59	28.03
Mrewa	0.05	22.38	27.48
Odzi	0.51	24.42	29.87
Rusape	1.02	26.91	25.08
Umtali... ..	0.90	26.31	24.16
Arcturus	0.08	42.50	29.29
Bindura	0.62	35.27	24.77
Concession	1.27	50.62	28.83
Glendale	0.13	32.52	27.17
Mazoe	Nil	33.83	26.77
Norton... ..	Nil	21.87	26.90
Salisbury	0.09	30.77	22.81
Shamva	0.47	29.80	26.09
Banket	Nil	30.02	25.30
Miami	0.52	34.39	22.51
Sinoia... ..	Nil	34.27	25.41
Sipolilo	0.64	26.85	26.16
Mtoko	0.07	30.65	23.50
Victoria Falls... ..	Nil	18.89	22.76
Mount Darwin	1.02	32.84	—

Southern Rhodesia Weather Bureau.

JANUARY, 1935.

Pressure.—The barometric pressure was generally about normal, being rather high in the south and low in the north.

Temperature.—Temperatures were generally rather below normal.

Rainfall.—The rainfall was fairly well distributed over the month, the heaviest general rains occurring from the 11th—15th, the average over the whole country was slightly above normal, Matabeleland being below and Mashonaland on the whole above. The total for the season was approximately 5 inches above normal at the end of the month.

The station Yeanling, Mr. W. H. Page (near Zawi) reported a remarkable fall of 8.87 inches between 9 p.m. and 2 a.m. on the 6th—7th of the month.

JANUARY 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen *F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.						Ins.	Nor- mal				No. of Days			
			Max.	Min.	Max.	Min.	Max.	Min.	Nor- mal.	Dry Bulb.							Wet Bulb.		
Angus Ranch...	...	...	100	60	85.6	67.2	76.4	77.2	75.3	69.3	74.0	5.81	5.80	10	...		
Belt Bridge	861.8	...	105	63	90.9	69.5	80.2	...	78.0	68.9	62.4	1.05	2.64	6	1,500				
Bindura	899.3	...	86	61	79.2	64.1	71.7	...	68.9	65.5	83.9	9.91	7.46	20	3,700				
Bulawayo	866.6	866.5	...	...	50.5	...	...	...	68.5	62.3	71.6	5.30	5.72	13	4,426
Clippinga	890.4	...	87	56	76.9	61.6	69.3	71.4	69.3	65.1	81.0	6.3	10.17	20	3,685				
Enkeldoorn	855.9	...	85	51	77.3	58.8	68.0	70.2	66.2	62.1	80.5	6.0	7.14	15	4,788				
Fort Victoria	893.3	892.9	90	52	80.5	61.6	71.1	72.3	70.1	64.5	74.9	3.07	6.43	14	3,571				
Gwaai Siding	902.0	...	94	53	86.8	63.4	75.1	...	72.2	66.7	75.5	6.3	5.78	9	3,278				
Gwanda	904.2	...	94	57	83.4	64.3	73.9	...	71.7	64.3	68.7	2.69	5.75	11	3,229				
Gwelo	860.4	...	88	52	78.6	59.2	68.9	71.4	67.5	62.6	77.0	9.81	5.98	14	4,629				
Hartley	883.2	...	87	53	80.8	61.4	71.1	73.3	69.4	64.9	79.3	8.73	8.13	14	3,879				
Inyanga	834.7	...	80	48	72.8	57.0	64.9	...	64.1	60.2	76.9	5.6	...	...	...	
Marandellas	835.8	...	82	49	73.6	58.0	65.8	...	64.5	60.5	80.4	5.7	8.66	18	5,453				
Miami	876.9	...	83	59	77.5	62.4	69.9	...	68.1	65.1	85.7	6.4	7.7	17	4,090				
Mount Darwin	905.2	...	88	58	81.0	64.6	72.8	...	71.2	67.5	82.9	6.6	8.34	15	3,179				
Mount Nuza	...	...	73	47	63.7	52.7	58.2	...	57.5	56.2	92.7	5.5	...	20	6,668		
Mtoko	875.4	...	88	58	79.7	62.6	71.1	...	69.6	65.6	84.3	6.3	8.13	18	4,141				
New Year's Gift...	...	...	93	56	82.7	62.9	72.8	...	72.2	67.1	77.0	6.5	...	12	2,690		
Nuanetsi	959.4	...	102	62	88.2	67.0	77.6	...	75.3	69.4	75.6	6.7	5.9	9	1,581				
Plumtree	862.6	...	87	52	80.6	61.1	70.8	...	69.0	61.7	67.2	5.8	6.30	14	4,549				
Que Que	879.9	...	88	52	81.5	60.6	71.0	...	69.1	63.9	75.3	6.1	6.81	12	3,999				
Rusape...	860.3	...	84	52	76.2	59.8	67.9	...	63.9	62.4	81.9	6.2	5.17	15	4,648				
Salisbury	...	...	84	53	77.7	59.2	68.4	...	68.2	62.1	73.0	6.7	7.36	15	4,885		
Shabani	905.4	...	96	60	82.8	64.1	73.5	...	71.2	65.7	75.8	6.2	4.01	16	3,193				
Sinoia	886.3	...	86	57	80.6	62.9	71.8	...	69.5	65.5	81.3	6.3	...	13	3,795				
Sipillo	883.1	...	83	55	77.6	62.3	69.9	...	69.3	64.6	76.7	6.1	7.57	15	3,876				
Stapleford	840.1	...	82	48	70.6	55.5	63.0	...	63.6	60.5	84.1	7.0	13.11	20	5,304				
Umtali...	890.5	890.9	93	53	80.3	62.0	71.2	...	70.1	65.7	80.6	6.2	8.35	16	3,672				
Victoria Falls	...	...	95	62	87.1	66.3	76.7	...	71.9	67.3	80.0	6.5	5.69	12	2,990		
Wankie	924.7	...	97	66	87.3	68.6	78.0	...	75.1	69.7	77.3	6.7	4.48	14	2,567				

Rainfall in January 1935, in Hundredths of an Inch. Telegraphic Reports.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal
...	...	...	24	2	15	45	16	1	...	24	58	69	26	27	...	...	...	54	24	...	42	3	...	..	...	...	...	...	...	52	482	533
...	...	...	...	12	11	79	3	...	25	58	104	64	59	91	2	...	...	7	2	...	40	43	8	4	...	...	...	...	...	42	654	742
12	...	...	...	116	1	65	66	39	40	28	215	78	91	27	16	3	...	5	5	5	1	106	39	21	...	...	...	...	...	27	1007	1087
...	7	...	...	72	35	73	34	6	20	49	103	55	122	68	11	...	...	31	156	10	33	10	3	...	...	...	...	...	...	1	899	697
...	...	...	71	37	64	15	29	8	...	16	72	63	10	24	19	...	...	14	8	28	26	6	...	...	...	...	...	...	...	32	542	663
...	...	4	...	10	117	84	15	28	62	69	82	16	79	139	2	...	...	30	9	46	14	...	...	...	...	...	...	...	...	7	831	746
1	...	13	...	87	28	85	38	30	39	71	115	31	83	93	16	15	...	...	6	16	15	18	21	9	...	...	...	...	...	10	840	911
...	57	1	...	26	52	74	68	64	117	100	95	54	37	78	73	100	9	6	51	34	8	67	16	1	7	...	...	...	...	..	1195	835
...	44	...	1	79	136	46	44	17	43	130	45	1	46	181	102	51	...	16	35	...	73	26	23	69	...	...	...	...	...	...	1208	855
...	...	3	...	2	...	33	9	71	127	73	68	81	119	87	98	30	...	1	97	93	31	20	1	47	...	...	...	...	...	...	1091	824
...	8	2	17	36	54	56	25	17	32	58	80	47	56	83	27	13	...	21	31	18	34	17	7	13	...	...	...	...	...	23	775	730

Farming Calendar.

MARCH.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irriga-

tion, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles *at once*. Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ¼ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphid and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbages and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Expert.

This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disc and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands;

irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial

control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, and on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "*Trichosoma contortum*," which is often fatal to ducks. It is found in the oesophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 374. Fibre Crops—Deacan Hemp (*Hibiscus Cannabinus*) and Sunn Hemp (*Crotalaria Juncea*), by J. A. T. Walters, B.A.
- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
- No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip. Agric., F.L.S.
- No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
- No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
- No. 634. Barley, by P. V. Samuels.
- No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
- No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
- No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
- No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip. Agric., F.L.S.
- No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
- No. 681. The Sunflower (*Helianthus Annuus*) (Revised), by S. D. Timson, M.C., Dip. Agric.
- No. 694. The Edible Canna (*Canna Edulis*), by D. E. McLoughlin.
- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip. Agric.
- No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
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THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

APRIL, 1935.

[No. 4.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Empire Tobacco Enquiry.—Information has been received from the Dominion Office that it is proposed to institute an enquiry into the marketing and future of Empire tobaccos in the United Kingdom. This enquiry is contemplated as a result of requests made by Nyasaland and Northern Rhodesia, and the Government of Southern Rhodesia has been asked to express its views on the subject. A reply has been sent stating that this Government would welcome such an enquiry, and concurring in the proposal that the Imperial Economic Committee would be a suitable body to undertake the work. It is anticipated that the Tobacco Associations will be given an opportunity to submit their views if such an enquiry is held. There is no doubt that such a measure is badly needed

and is of the utmost importance to all Colonies and Dominions producing flue-cured and Turkish tobaccos. The Governments of Northern Rhodesia and Nyasaland have now been approached with the idea of arranging a joint conference in Salisbury at an early date with a view of putting forward suitable joint recommendations for the consideration of the Committee of Enquiry when appointed.

Cowpea Parasite on Msasa Roots.—Mr. J. Morten Spencer, of Morven, Hartley, recently sent in a specimen of *Alectra vogelii*, the cowpea parasite, found growing in numbers, obviously on the roots of a young Msasa tree. It was stated that the spot where the tree was growing was in virgin bush at least half a mile away from where cowpeas had ever been grown. It appears possible, therefore, that Msasa is one of the natural host plants of *Alectra* but that it can only exist on young trees while the roots are soft and near the surface of the soil. *Alectra vogelii* was described and illustrated in this *Journal* for November last, and it is possible that it is much more common and widespread than the records in this Department would seem to indicate. It will be appreciated, therefore, if anyone finding this plant will inform us, stating at the same time the plant upon which it was growing.

Cement for use in Water Conservation Works.—The Chief, Division of Irrigation, wishes to draw attention to the following particulars of an arrangement made with the Premier Portland Cement Co. (Rhodesia) Ltd., whereby supplies of cement at reduced rates are available to farmers for use in water conservation works.

1. Farmers who obtain a loan from Irrigation Loan Funds or from the Land Bank for the purpose of constructing water conservation works can obtain the cement required for the construction of these works on a Government requisition at a reduced price of 2s. 9d. per bag (95 lbs.), f.o.r. Cement Siding, in minimum lots of 24 bags. The requisition for the supply of the cement will be issued by the Irrigation Engineer responsible for the inspection and supervision of the works proposed

2. Farmers who do not desire a loan and are willing to pay cash for the cement required for the construction of water conservation works, may obtain the benefits of the reduced rates subject to the following conditions:—

(a) A cheque in favour of the Premier Portland Cement Co. (Rhodesia) Ltd., should be sent to the Chief Irrigation Engineer, Box 387, Salisbury, or to the Irrigation Engineer (Matabeleland), Box 566, Bulawayo. Such cheque to cover the cost of the cement at ordinary rates, namely, 3s. 7½d. per bag (95 lbs.) for lots of 50 bags or over, and 3s. 9d. per bag for smaller quantities limited to a minimum order of 24 bags, plus railage charges if the cement is to be consigned to a siding and the railage charges have to be prepaid.

(b) After an inspection of the works by a Government engineer and certification that the cement has been utilised in the construction of these works, the difference between the price paid and the reduced price of 2s. 9d. per bag will be refunded to the farmer by the Cement Company.

Egg Laying Test.—The Fifteenth Annual Official Egg Laying Test closed at the Government Experimental Station, Salisbury, on the 30th January, 1935. The results achieved were satisfactory in regard to production, health and condition of the stock. The mortality recorded was only 8 per cent. and represents the lowest mortality of any previous test. Monthly records were issued to all competitors and were published in the newspapers throughout Rhodesia and in the *South African Poultry Magazine*.

The successful competitors were:—Heavy Breed Section: The Dunowen Poultry Farm and R. Raynor, Darwendale. In the Light Breeds the team owned by R. Porritt, Esq., of Maritzburg, held first position with Mr. E. E. C. Green, of Bulawayo, a close second. The production of these pens exceeded 1,000 eggs in 48 weeks. Other competitors whose teams did well were W. A. Bull, Esq., Maramba Poultry Farm, and R. G. Newton, Esq.

Thirteen birds qualified for registration in production for the duration of the test, and of this number twelve birds passed the all-round qualification.

The highest individual record was 255 eggs.

The Sixteenth Annual Test commenced on the 1st March. It is gratifying to note that there are more entries on this Test than in the one just terminated, and there are a number of new competitors. It is worthy of note also that in addition to an increased number of team entries, twenty-three birds are competing in the section for individual birds.

Many well known producers and distributors of reputable stock in Rhodesia and the Union figure in the list of competitors. These annual competitions are, among other things, a guide to would-be purchasers of day-old chicks and stud stock.

Permits to Import Farm Produce.—Under Article IX. of the Trade Agreement with the Union of South Africa certain classes of farm produce can only be imported on permit. The granting of permits to import the following articles is subject to the consent of the Minister of Agriculture and Lands, and applications for such permits must be made to the Secretary, Box 387, Salisbury:—Potatoes, maize, maize products, ground nuts, vegetable oils, eggs, butter, cheese.

All applications for permits must give the following particulars:—

- (a) Name and address of importer;
- (b) Station to which goods will be consigned;
- (c) Nature and quantity of goods to be imported;
- (d) Name and address of exporter or consignor.

Permits will only be considered where the Minister of Agriculture and Lands is satisfied that a shortage of these products exists in the Colony, thereby rendering importation from the Union of South Africa desirable. Importations will be limited to specific quantities, and permits will not be issued to cover extended periods of time. Applications should be received sufficiently early to enable the permit, if approved, to be despatched to the importer prior to ordering the goods.

Queensland Trains Primary Producers.—The St. Lucia Farm School, near Brisbane, founded by Mr. Frank W. Bulcock, Minister for Agriculture and Stock, Queensland, and opened by him on January 31, 1933, has fully justified his hope of promoting “a land consciousness in the city youth.” Boys are taken between the ages of fourteen and twenty-one years. It is regarded “as an important social movement designed to counter the effects of the existing economic situation by directing the youth power of the land into fields of primary production.” The farm consists of about 170 acres and there is a tent camp in forest country at Moggill. The land at St. Lucia and Moggill belongs to the Queensland University and was offered for the purpose because the University is not likely to occupy the area for some years to come and it was the general belief that it could not be put to better immediate use. Groups of the boys are taken from time to time to Beerburrum, where they receive tuition in tobacco cultivation and the curing and grading of tobacco leaf. Since the first trainees completed their course the demand for boys trained at St. Lucia has far exceeded the supply.

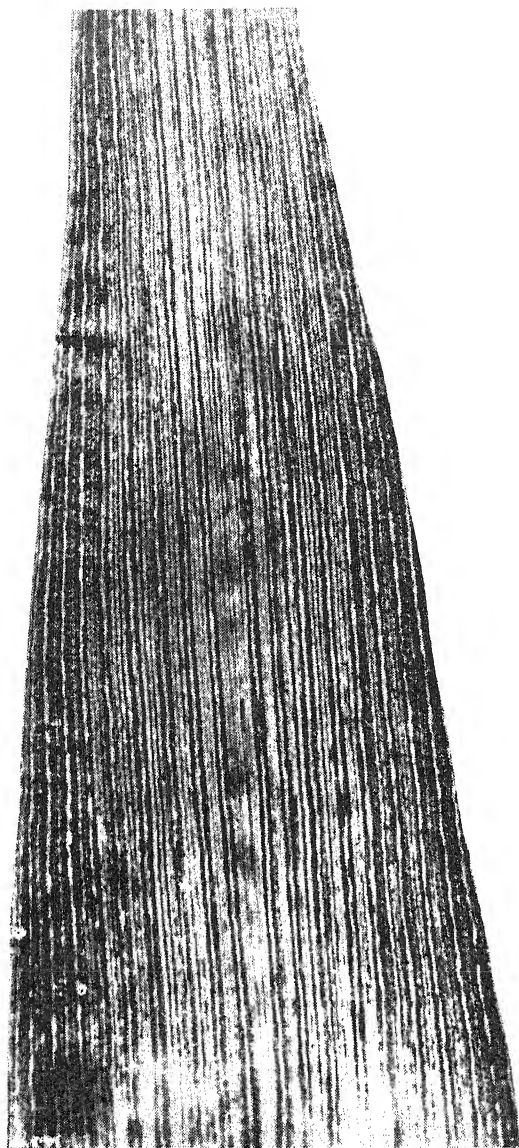
Suspected "Streak" Disease of Maize.

NOTICE TO GROWERS.

By J. C. HOPKINS, D.Sc. (Lond.), A.I.C.T.A.,
Senior Plant Pathologist.

Within the past few weeks the attention of the Plant Pathological branch has been directed towards a disease of maize closely resembling that known as "streak," which has been shown by Storey⁽¹⁾ to be caused by a virus. The streak virus is carried from diseased to healthy plants by a small leaf-sucking insect of the Jassid family, which is also capable of transmitting the disease to other cultivated and wild grasses. The disease is well known in the Union and has been recorded from East Africa, but up to the present time it has not been known to occur in Southern Rhodesia. During the last four or five years diseased maize showing yellowing and striping of the leaves has been sent to the Plant Pathology laboratory from time to time, but no specimen has conformed to the typical symptoms described for streak, and leaves sent to Dr. Storey, at Amani, have been reported upon as not being affected by streak disease.

It appears probable, however, that the material recently received is true streak disease, and transmission experiments with jassids collected from affected plants are now in progress. No positive results have as yet been obtained, but it is considered advisable to endeavour to ascertain the distribution of the disease in the Colony before the close of the present season. A photograph of an affected leaf is therefore being published together with a description of the symptoms, and it is hoped



Suspected Streak Disease of Maize.
Farmers are asked to send in specimens showing these symptoms.

that anyone seeing plants so affected will be good enough to report the occurrence and send in specimens by official post. Leaves should be pressed between several sheets of newspaper, rolled up and tied with string. They should be addressed to

The Senior Plant Pathologist,
Department of Agriculture,
Salisbury,

and should bear some indication of their origin. A fuller report on time of planting, degree of infection, stage of growth of the crop, type of soil, etc., will also be welcome.

Symptoms.—The most pronounced feature of the disease is the occurrence of pale yellow, narrow, broken stripes running along the veins of the leaf and confined to the veins. The latter character can best be seen near the margins, by holding the leaf up to the light when the contrast between dark green and pale yellowish green or yellow becomes more accentuated. Nearer the midrib the pale stripes may coalesce laterally to form a wider band, but the distinctive "streaking" continues to remain prominent.

In the field, affected plants may be picked out readily, the pale colour and striping of the leaves being prominent. Not all leaves are affected, the older ones at the bottom of the stalk being normal in appearance unless affected by some other adverse condition such as chlorosis caused by drought or witchweed. Streak-infected maize may be distinguished from that affected by some physiological trouble caused by malnutrition by the presence of typical narrow, broken stripes in the youngest unfolded leaves. Usually a condition of debility is indicated by the pale colour of the older leaves, which is often accompanied by various kinds of striping, and this should not be confused with the symptoms just described.

Storey has shown that streak disease of maize is not transmissible through the seed, neither can it be spread by mechanical transfer of infected juice. The only method of natural spread is by means of the insect previously referred to, not to be confused with the cotton jassid, which belongs to an entirely different genus.

SUMMARY.

1. A disease of maize, closely resembling streak, has been reported for the first time in Southern Rhodesia.

2. A description of streak disease, which is due to a virus, and its method of spread by means of insects is given.

3. Farmers and others are asked to assist the branch of Plant Pathology in ascertaining the distribution of the suspected streak disease by sending in reports of its occurrence and specimens.

4. Specimens may be sent free of charge by official post.

5. Streak disease cannot be spread by handling plants nor is it transmitted in seed.

REFERENCE.

- (¹) Story, H. H.—“The Transmission of Streak Disease of Maize by the Leaf Hopper *Balclutha mbila* Naude.” *Ann. App. Biol.* xii., 4th Nov., 1925.

The Control of Tsetse Fly in Southern Rhodesia.

By RUPERT W. JACK, Chief Entomologist.

(Lecture before the Rhodesia Scientific Association,
Salisbury, March 13th, 1935.)

In the year 1909 when I first arrived in Southern Rhodesia to fill the post of Government Entomologist, tsetse fly was giving trouble on some newly occupied farms between Hartley and Gatooma in the Hartley District, and I was informed that one of my more important duties would be the study of the tsetse fly problem in the Colony.

Up to that time practically no research had been carried out with the most widely distributed tsetse fly of all, namely, *Glossina morsitans*, the only species with which we are concerned in the northern part of Southern Rhodesia. Even its immature stages were unknown and its natural breeding places had not yet been discovered.

Since then a great deal of water has run under the bridge, and at the present day we probably know more about the life economy, behaviour and habits of *morsitans* than of any other species of tsetse fly, with the possible exception of *G. palpalis*.

Apart from work in this Colony which, for lack of proper facilities for uninterrupted research, has perforce been of an intermittent nature, a great deal of attention has been paid to this species in Northern Rhodesia, Nyasaland, Tanganyika, Uganda, the Belgian Congo, Nigeria and elsewhere.

The biggest organisation for the study of tsetse flies is the Department of Tsetse Research in Tanganyika, of which Mr. C. F. M. Swynnerton is the Director. The next largest is the "Tsetse Fly Investigation" in Northern Nigeria, which

has been at work for a number of years. These organisations are concerned, not only with a study of the biology of the flies, but also with experiments with control measures.

Before proceeding further there are certain facts which it is necessary to state.

In the first place it must be realised that there are some twenty different species of tsetse flies, all confined to the Ethiopian region, and all, except one, to the continent of Africa and adjacent small islands. One species, namely, *Glossina tachinoides*, occurs also in the southern point of Arabia. These different species exhibit considerable variation in regard to habitat, habits, behaviour, etc., and statements applicable to one species are not necessarily applicable to another. This has led to considerable confusion in the public mind. People are apt to think that the term "tsetse fly" applies only to one insect, and that there is only one Tsetse Fly Problem. On the contrary, there are a number of different problems created by tsetse flies. Some species are of most importance in reference to transmission of Human Trypanosomiasis or Sleeping Sickness. This is the case with the notorious *G. palpalis*, which was the cause of the death of at least 200,000 natives in Uganda in the period 1901 to 1906. Most of the species are only known to be of importance in regard to the transmission of Animal Trypanosomiasis, but *G. morsitans* is capable of transmitting disease to both man and animal.

In the course of this lecture, unless otherwise stated, the term "tsetse fly" will refer to *G. morsitans*.

Now a few points concerning the life economy of tsetse flies and *G. morsitans* in particular:—

All tsetse flies are bloodsucking insects and differ from some other species of bloodsucking flies, such as mosquitoes, horse flies, blind flies, etc., in that both sexes suck blood. Furthermore, there is no reliable evidence at all that they take any food except blood. They are, in fact, independent parasites on red blooded animals, and are no more capable of sustaining themselves in the absence of such animals than a louse or a tick. In this connection it should be mentioned that the term "animal" in the zoological sense includes the whole animal kingdom and is not confined to mammals.

The life cycle of tsetse flies is extremely simple. The maggots or larvæ are produced one at a time and attain full growth within the mother fly. After birth, they need no nourishment, but simply wriggle into the soil, if sufficiently soft, or under other available shelter if not, and within a few hours change into black puparia (chrysalis stage of butterflies and moths). From these the perfect flies emerge within a period ranging from about three weeks to several months, according to the temperature.

The rate of breeding is very slow for an insect, as, even in the height of the breeding season, the maggots are produced at the rate of only about one in a fortnight. Twelve offspring is probably a large family for a tsetse fly, compared with, say, six hundred in the case of a house fly.

Study of the breeding of *morsitans* in its natural habitat has led to the discovery that the maggots are dropped in almost any spot affording the necessary shade. A favourite site is under the prostrate trunks of fallen trees, but hollow trees are utilised largely, especially at certain times of year, whilst the banks of dry water courses, overhanging rocks, the division between the exposed roots of large trees, hollows in the soil, etc., have yielded an abundance of puparia. It is clear, in fact, that all that is needed for the young stages is a small patch of shade. Too much exposure to the sun will kill the puparia.

All tsetse flies are forest insects, and are unable to persist in extensive tracts of open country. Shade is a necessity to them. They tend to desert forest which becomes leafless in the latter part of the dry season, and to confine their movements to forest still in leaf. This is particularly apparent in areas which include large tracts of mopane forest, which is markedly and consistently deciduous. It is less apparent where the dominant forest is irregularly deciduous, as the tracts of leafless forest are then limited in extent and flies may pass through them comparatively freely.

Finally, the distribution of tsetse flies is limited by climatic factors. In Southern Rhodesia *morsitans* has never been recorded as occurring above an altitude of about 4,000 feet; in fact, over a considerable distance on the north-west

side of the main watershed, the former limit follows approximately the 4,000 foot contour. Where the ground has an aspect with an easterly element the former limit tends to follow a considerably lower altitude, in some places not exceeding 2,500 feet. This may be due to the occurrence of "mist belts" along bold rises in the ground with an easterly aspect. Excessive humidity is unfavourable to *morsitans*.

There is no evidence that any part of Southern Rhodesia is too hot or too dry for *morsitans*, but a considerable portion of the Colony is either too cool or too humid for this species.

The three fundamental requirements of a tsetse fly are, therefore: (1) a suitable climate; (2) suitable shelter in the form of vegetation and (3) a sufficient and suitable food supply.

In order to make the present tsetse fly position in this Colony clear, it is necessary to go back to the past century.

At the time when David Livingstone and subsequent explorers were travelling about this part of the world, Southern Rhodesia from all accounts was infested with tsetse fly to the extent of about half its area (see map). There is evidence, however, that in the south and extreme west the fly areas had broken up considerably by 1890 coincident with the activities of the hunting fraternity, who attributed the disappearance of fly in various parts to their own inroads into the game, more especially buffalo. The Matabili, who came to Bulawayo about 1836, took a considerable and continuous part in this destruction. The explorer Karl Mauch had the very good sense to leave a map of the fly limits in 1865-1869, which is embodied in the present-day maps. It figured only the part of the Colony from the longitude of the eastern boundary of the present Hartley District westwards. Selous and other hunters left many records of tsetse fly in the Colony, and there are natives and Europeans living to-day who have been able to supply information from personal experience concerning the former distribution of the fly. As a matter of fact, information in this connection has been gathered from a large number of different sources.

By 1896 there is no record of any considerable change in the fly position on the north-west side of the main watershed

except the extreme west, but the fly infested areas in the Limpopo, Lundi and Sabi Valleys had apparently become patchy.

The year 1896 was a critical one in the history of the Colony in more ways than one, but we are only concerned with the Rinderpest epizootic.

This apparent misfortune was followed by the total disappearance of tsetse from the southern part of the Colony and the shrinkage of the great infested area in the north to a few isolated spots in the districts of Sebungwe, Hartley and Lomagundi. We have direct evidence as to the location of practically all of these survival localities.

Experience in the Transval for half a century had led to tsetse fly being regarded as an ephemeral scourge, and the general impression after 1896 in Southern Rhodesia appears to have been that the fly had disappeared or was on the point of disappearing.

Such optimism was destined to be short-lived. Fly began to make its presence felt again from about 1901, especially in the Hartley District, where there was much mining activity.

It soon became evident that the fly was increasing again, and in 1905 a large portion of the Hartley District was thrown open to free shooting with a view to checking this menace. It was closed for one year in 1908, but was opened again in 1909, shortly before I came to Salisbury.

Although cattle were contracting trypanosomiasis on the occupied farms in the Hartley District, between Hartley and Gatooma and on the Umfuli River, fly in 1909 was present only in very small numbers. The fly area was small and surrounded on all sides by mines and farms. The game was, of course, greatly depleted and the fly was evanescent. The *coup de grace* appears to have been administered by temporary clearance of the heart of the fly area in connection with a wood contract for the Cam and Motor mines, commencing in 1912. The Department stipulated that the concession was not to be exploited on the basis of selective cutting, but that the whole forest must be levelled. There was, however, very little

fly in the area when the cutting commenced, and there is veterinary evidence to the effect that trypanosomiasis had greatly decreased by 1912.

That the fly in other parts was still spreading was abundantly clear, both from my own journeys and from reports of Native Commissioners, Police, etc., in the districts concerned. Apart from Suri-Suri belt in the Hartley District, with which we have just dealt, the fly was still, however, remote from settlement and the position was not acute.

In 1918, however, the fly, spreading in a south-westerly direction from the great Sebungwe fly area, began to infect cattle along the Gwaai River, one isolated European farmer being involved.

The first suggestion to deal with the situation was to clear a mile width of forest across the front of the advancing fly. In 1918 some three hundred natives were assembled for this purpose. The influenza epidemic, however, interfered with the work and the operations were terminated after only about one and three-quarter sq. miles of forest had been levelled. Subsequent experience has, in any case, shown that a mile wide clearing would be ineffective against *morsitans*. Early in 1919 a conference was held at Salisbury, presided over by the Administrator, and it was decided to attempt to drive back the fly in this salient by destroying the game. These operations commenced in June, 1919, and were terminated in 1922, by which time the fly had receded far enough to clear the Gwaai River of trypanosomiasis. The native herds remained healthy and increased during the next five years, and cattle were brought back again to the farm mentioned, where they remained without loss.

Unfortunately the operations were discontinued after 1922 and game began to increase again with the result that the fly showed a renewed tendency to advance. In 1927 cattle began to die again from fly disease on the Gwaai River, and as nothing effective was done for several years the fly increased enormously between the Gwaai and Shangani Rivers, and spread much further afield than in the first instance. When intensive operations were again renewed in 1931, the position was very bad indeed and, whilst fly is

decreasing in intensity in this region, we can as yet record no definite retrogression as a result of the present operations.

In the Lomagundi District in 1922 fly commenced to spread south-east from what had been known as the Tchetchenini fly area, destroying native cattle, and in 1923 cattle began to die on occupied farms on the east side of the Hunyani River. By 1924 cattle were also dying on various farms between the Hunyani and Angwa Rivers. Native cattle in the Sipolilo Reserve were also affected. In short, a very serious position had developed.

Operations against game in the Sipolilo sub-district were commenced under the direction of the Assistant Native Commissioner in 1924, and have continued to this day, with the result that the whole sub-district south of the escarpment has been practically cleared of fly.

Similar operations were commenced the same year west of the Hunyani.

In May, 1925, in view of strong representations from the local farmers, a conference, presided over by the Minister of Agriculture and Lands, with representatives of farmers concerned, was held in Salisbury. This conference was in favour of an intensive policy of game reduction. This led to the erection of game fences, ten miles apart, between the Hunyani and Angwa Rivers, which distance was later increased to twenty miles. This measure has been highly successful. The position began to improve from 1927 onward. The fly has now receded some twenty miles or more, and no cases of trypanosomiasis have occurred in the farming area for something approaching two years. Only two farms have had a few cases since 1930. It is estimated that about 1,100 sq. miles of country have been virtually cleared of tsetse from the Sipolilo sub-district to the Urungwe sub-district in the course of these operations.

In 1925 settlement, extending from the east in the Hartley District, encountered tsetse fly extending from the west and another very acute position developed. This was dealt with on the same principle as the Lomagundi section just mentioned; operations commencing in 1927 with two game fences, completed in 1928. These operations have been extended north and south to meet the tendency of the spread-

ing fly to outflank the barrier. Progress has been slower than in Lomagundi, due to the facts that fly was really dense close up to the settlement, that the operations were hampered by scarcity of permanent water, and that a good deal of thick country was included in the area.

In September, 1932, an additional zone of ten miles was taken over, as the original ten mile zone was judged to be too narrow. Trypanosomiasis has not yet disappeared altogether from the farming area, but the number of cases has decreased very greatly. The fly has receded and in no part of the original ten mile zone is more than an occasional fly seen at the present time. It is estimated that about 500 sq. miles have been virtually cleared of fly in this section. The original high densities show unmistakeable signs of breaking up in the new zone on the western side.

In 1930 similar operations were undertaken to protect the farms in Lomagundi West as fly was found to be spreading from the Umfuli River northward. These have had a fully satisfactory effect, and some three hundred square miles of country have been cleared of the pest in this part.

In 1929 a conference of Native Commissioners was held at Salisbury to consider native interests in relation to the spread of tsetse fly, and it was decided to endeavour to complete a game reduction cordon around the whole fly area. This was given effect in 1930.

By this means the fly in general appears now to be held in check, although a small advance has occurred in the neighbourhood of the Urungwe Native Reserve during the past few years. This was anticipated and is due to the very broken and waterless nature of the country in the western half of the reserve, making effective hunting almost impossible, and possibly the reluctance on the part of the Department to permit elephant and rhinoceros, which occur there in considerable numbers, to be destroyed. There is little doubt that the fly in this locality can be held successfully where the terrain is more suitable.

At the present time Southern Rhodesia is the only country known to me which is menaced with spreading tsetse fly (*morsitans*) where there is reason to judge that the position as a whole is under artificial control.

My estimate is that once certain objectives have been obtained such control can be maintained at an expenditure of about £5,000 per annum.

Now, the destruction of game is a measure which is abhorrent to all of us, and it certainly would not have been undertaken if any feasible alternative were available to deal with our particular problem. It is the nature of the problem which determines the feasibility or otherwise of various control measures.

In this connection let us turn our eyes for a moment to the eastern border of the Southern Masetter District, the Chipinga area in fact.

This is a populous part of the country from the agricultural point of view, and is considerably developed. It is adjacent, however, to altogether primitive African conditions in Portuguese territory, the border being not only a political, but also a natural one in that it follows more or less closely the edge of the high veld.

Two species of tsetse fly occur near this portion of the border in Portuguese territory, namely, *Glossina pallidipes* and *G. brevipalpis*. These, at least *pallidipes*, apparently receded in 1896-7, but have gradually spread until at the present time they are permanently established very close to the border, and possibly even within this Colony in one or two deep river valleys.

From 1914 onwards farmers on the border farms began to lose cattle from fly disease, due to incursions by occasional flies, and these losses have continued until at least last year. Farms have been evacuated on this account, and cattle have been evacuated from farms, otherwise occupied. Only two tsetse flies have so far been actually taken within our borders, both *pallidipes*, which is the species probably responsible for the losses.

Now, until comparatively recent years, very little was known concerning the specific habits of *pallidipes*, and even to-day, apart from Mr. Harris' fly traps in Zululand, little experience in control of this species seems to be available.

Study of this species has, however, revealed the fact that it differs considerably from *morsitans*, both in regard to environmental requirements and behaviour.

Two important differences are (1) that *pallidipes* is markedly more shade loving than *morsitans*, and (2) that *pallidipes* does not attach himself to man and "follow" for miles as does *morsitans*.

In connection with the situation in the Chipinga sub-district, various proposals had been made by local farmers, including (1) the shooting out of the game near the border in Portuguese territory—an impossible task on account of the nature of the country and the fact that it is foreign territory; (2) the erection of a game fence along the border. The latter was considered in some detail and abandoned on account of the nature of much of the country and the depth of the grass, which produces exceedingly fierce grass fires in some places.

The last suggestion was a border clearing.

Now, I do not think the game was responsible for bringing the fly across the border, and in my opinion the game fence would have been useless for the purpose intended, except in so far as it kept cattle from straying over the border. The investigators in Zululand could not induce *pallidipes* to follow cattle for any distance, and there is no reason to think that it would follow game any more persistently. The border clearing was another matter but, having only the experience with *morsitans* as a guide, it did not seem that any feasible clearing would serve as a safeguard, in view of the facts (1) that this species follows man for up to ten miles or more, (2) that there is abundant foot traffic to and fro across the border, and (3) that even in the absence of traffic, this fly will cross quite a wide strip of open country. The discovery that *pallidipes* does not follow man, however, coupled with the fact that it is more shade loving than *morsitans*, put a different complexion on the matter, so that in 1932 I was in a position to advise the Government that a comparatively narrow clearing presented a reasonable prospect of success.

This clearing was rendered feasible by the fact that open grassland predominates along the portion of the border concerned, and that the forest requiring removal covered probably

less than 10 per cent. of the ground. Also, that by utilising certain high ridges, the clearing could be made very narrow along certain sections.

A clearing has now been created along some thirty odd miles of the border at a cost of about £1,500, extended over three years. It is too early to state with certainty what permanent effect this will have, but the indications up to the present are very encouraging, so much so that cattle have been moved back in large numbers to previously evacuated farms. The main difficulty with which we are now confronted is maintenance of the clearing.

This will serve to illustrate the value of a close knowledge of the life economy of insects in reference to control measures, and the fact that different species of tsetse flies may create quite different problems under different circumstances.

Let us now revert to *morsitans* in the northern part of the Colony and consider the problem presented.

The actually infested country is on the whole of very poor quality and is mostly unsuited to European settlement. There is really no serious demand at present for intensive measures to reclaim considerable portions of this country from the fly for the use of either Europeans or natives. Whilst it is necessary to drive the fly back further from settlement in the Hartley and Wankie Districts, we are mainly concerned, in the present stage of development of the Colony, with preventing the fly from spreading into occupied areas or overrunning country of real agricultural value.

To achieve this, it is necessary to oppose a barrier to the fly's advance along practically the whole fly front. In the absence of such a barrier, it is of no use to spend money attempting to reclaim 100 sq. miles or so here and there. The fly would simply continue to spread elsewhere and would certainly overrun more country each year than was reclaimed.

The public generally fail to realise this essential point and there is a tendency to imagine that the Government is trying to drive the fly out of the Colony by destroying the game. This is far from the truth. No attempt has as yet been made to reclaim one sq. yard of new country for settle-

ment. Any eviction of fly which has occurred in the course of the operations, has been incidental to protection of existing settlement. All that is being attempted is to establish and maintain a zone varying from ten to twenty miles wide, approximately free from game, between the fly and the farms, or other localities it is desired to protect. It is not the 20,000 sq. miles of infested country we are concerned with so much as the 30,000 sq. miles of much more valuable country which the fly threatens to overrun in the northern part of the country. The effort of the operations cannot be judged on the basis of the area actually cleared of fly, although this is considerable.

In spite of assertions to the contrary, the game of the Colony as a whole, is not being menaced by these measures.

The 20,000 animals destroyed annually at the present time consists, to the extent of about 60%, of small buck, pig, carnivora and animals other than large game. Game does not figure in the Census returns, of course, but in my judgment the annual number destroyed probably does not equal the natural increase of the game in the northern part of the Colony as a whole. Apart from the tsetse fly cordon, the game in the uninhabited parts is protected, either completely or in a very considerable degree, and there is undoubtedly far less poaching than there was before the cordon was completed and control established.

It must not be overlooked that European settlement, and even a moderately dense native population, are in themselves incompatible with the presence of large numbers of game animals. The portions of the Colony containing least game at the present day are not the areas of the Government's anti-fly operations but the areas which have been in closest occupation for the greatest length of time.

In regard to reclamation measures, with which research work in tsetse fly has been mostly concerned, it is therefore to be realised that *whatever measures were adopted to banish tsetse and to open up more and more country to occupation they would inevitably have a repercussion adverse to the game.*

Game feeds the tsetse, but in return the presence of tsetse to a large extent protects the game.

The ideal, with the object of reducing the necessity for slaughter as much as possible, would be to have the fly cordon enclosed throughout with 100% effective game fences, but I am afraid that the Colony would have to have a very heavy bill if this were attempted.

The desire is, of course, to obtain some feasible alternative to game destruction for controlling tsetse.

With this idea in mind, we may turn hopefully to some of the latest publications of, say, the Department of Tsetse Research in Tanganyika. The following is an extract from a contribution to the *Tanganyika Standard* by the officers of that Department last year:—

“Our fullest investigation of habits has been on *G. morsitans*, and we know it exceedingly thoroughly; but our field experiments on this species, in which the suggestions from our observations on it will be tested out, are only commencing now—and that haltingly—as a result of shortage of staff and money. We are very hopeful as to the ultimate result, but this important fly holds us at a disadvantage in the meantime.” . . . “As regards the vexed question of the game animals, it is not considered likely that they will be called upon to contribute heavily to the destruction of *G. palpalis* and *G. swynnertoni*, and it is hoped that the same may prove true in the end as regards *G. morsitans*.”

There is obviously not much help in the direction of immediate alternative action against *morsitans* in this extract.

Now, as I have already stated, the three fundamental requirements of tsetse flies are (1) suitable climate, (2) suitable vegetation and (3) sufficient food. Apart from direct attack on the fly itself, it would be necessary to alter one of these requirements to the fly's disadvantage in order to get rid of it. Obviously we cannot alter the climate as a whole, and we are at present attacking the fly through its food supply.

The alternative is, therefore, to attempt to modify its vegetational shelter. Possibilities in this direction may be considered under various headings as follows:—

1. *Total Removal of Forest*.—This is a definitely effective method of reclaiming country from tsetse and has, in

fact, been utilised to some extent in Tanganyika with unpaid tribal labour. It is far too expensive with paid labour, as a reclamation measure, and is in many respects objectionable.

For our purposes, we may, however, consider it from the point of view of a barrier clearing to arrest the fly's advance.

One of the first difficulties to contend with is that in spite of considerable experiment with widths of clearings in Tanganyika, we do not yet know for certain what width of open country would definitely stop *morsitans*. It is a very difficult matter to determine by experiment. We are informed that in Nyasaland *morsitans* a few years ago advanced across a clearing a mile wide apparently without a check. The present opinion is that two miles is the absolute minimum for *morsitans* and that the clearing must be settled with natives for maintenance and to stop game crossing.

Clearings of a permanent nature are very expensive to create in country which is at least 90% forested, like the margin of our present fly area. Neither stumping or burning the stumps produces a permanent clearing in the dominant *Brachystegia* (Msassa, Mfuti, etc.) forest. Poisoning is more hopeful, but is apparently more expensive than burning the stumps. Ring-barking is only partially effective and takes a long time to produce a clearing.

If we were to attempt forthwith to create a two mile wide really permanent clearing all along our fly front, it would undoubtedly cost a very large sum of money indeed, and, as it could not be relied upon to effect its object, such an undertaking has obviously been out of the question, as far as meeting the emergency is concerned.

It does not follow that something of this nature could not be developed gradually once we were sure of results, but the expenditure would undoubtedly have to be spread over a large number of years. It would, however, be necessary to hold the fly in check by other measures in the meantime.

Unless clearings can be settled closely with natives they will inevitably demand recurrent expenditure in maintenance which, in the case of really extensive clearings, would be very considerable.

It is in this respect that Southern Rhodesia is very heavily handicapped. Tanganyika is short of fly free land for native occupation with cattle, as some of their tribes will not continue to inhabit country in which cattle cannot be kept. The Makorekore, Chikunda, Bashankwe, Batonka, etc., living in our fly areas do not fall into this category. They have apparently lived for many generations in fly infested country, and whilst they have a tendency to acquire cattle in fly free areas, they do not evacuate their ancestral homes when fly returns.

The native population of our fly areas is comparatively small, and there are not nearly enough natives closely to settle a clearing all along the fly limit. It is obvious that natives cannot be moved wholesale from fly free parts and settled along the fly limit, at least until shortage of land elsewhere enforces such action. At best they would be exposed to the risk of loss of livestock, and at worst might contract sleeping sickness in some areas by wandering into the fly area, which, if game were protected, would certainly become very densely infested. Advance in medical and veterinary science might, of course, modify the position somewhat.

Another apparently insurmountable difficulty is the nature of the country along the fly limit which in many parts is of exceedingly poor fertility and unsuited to support a large native population.

It is to be realised that, if game is to be protected, the tendency of the fly to pass any barrier will become very strong indeed, and it is quite obvious that the barrier would need to have no weak sections if the fly was to be held back indefinitely by this means.

I may say that a barrier of combined European and native settlement has been created in Nyasaland across a wide valley with natural mountain barriers on either side. The area is particularly suitable for growing the class of tobacco in which Nyasaland specialises. According to available information, this barrier is not settled sufficiently closely to keep down the forest, but it is included in an open shooting area which extends for a considerable distance in the direction of the fly. Apparently, in this case, settlement is being used as an aid to game reduction and not as a substitute for it.

2. *Selective Forest Clearing*.—Experiments in reference to removing essential elements of the forest, as opposed to total clearing, have been carried out in various parts of Africa, particularly in Nigeria, where the results obtained against *morsitans* have been only partial. They are, I understand, being prosecuted at present in Tanganyika against *morsitans*. They are usually based upon the need of the fly for shade during the late dry season when the dominant savannah forest of the locality may become entirely leafless. The feasibility of the measure depends greatly upon the nature and habit of the dominant forest, which is determined by climate and soil.

An experiment of this nature was commenced on the Gwaai River in 1928, but was discontinued before any considerable area had been treated.

There are possibilities in this measure in certain areas, particularly those dominated by mopane forest, but it is certainly not applicable over the whole fly front. It is a measure calling for careful experimental investigation in each piece of country concerned. It is on the whole a distasteful measure, as it commonly involves the destruction of the finest evergreen trees in the locality, the object being to make the whole country shadeless in the hottest period of the year. It would best be applied to the creation of a barrier in the form of a zone of country unsuited to permanent occupation by the fly.

3. *Controlled Grass Burning*.—One of the first measures tested in Tanganyika was the protection of the grass until late in the dry season, followed by an organised burn on a large scale with a high wind.

This can be utilised for a direct attack on the fly or for modifying its vegetational environment.

In thickly grassed areas, the result is to burn out the thickets and generally to suppress the undergrowth. In this way it has proved effective to a considerable extent against the tsetse fly *G. swynnertoni*, which is largely dependent upon thicket and lives in thickly grassed country.

Another effect is to drive the flies into areas which will not burn, and here they can be caught. It also destroys a

proportion of the puparia but, as the grass can only be burnt once a year, in this Colony at any rate, and the fire takes place during the period when the pupal period is shortest, the destruction of a portion of the puparia present at the time cannot have much effect on the fly as a whole.

Apparently the measure has been found useful in parts of Uganda against *morsitans*, but it has been tried for four years and abandoned in Nigeria. We tried it out for two years in the Lomagundi district in this Colony, and the results were very discouraging. As a matter of fact, Mr. Swynerton, who is responsible for this measure, admits that much of the country included in the *morsitans* areas which he has seen in this Colony is not suited to its adoption and apparently much of the Tanganyika fly area is similarly unsuited.

4. *Clearing Undergrowth*.—A suggestion has recently been put forward to the effect that the fly is dependent upon undergrowth, and that natives should therefore be armed with sickles, cane knives, etc., and set to clear out the shrubs.

The association of any species of tsetse fly with particular types of vegetation is largely influenced by the optimum humidity for that particular species of fly. Thick vegetation tends to increase the humidity, and in the case of such a fly as *palpalis*, which needs a very high humidity, clearing the undergrowth has had a beneficial effect, presumably by reducing the humidity. *Morsitans* is not generally regarded as being dependent upon undergrowth. It is essentially an open forest tsetse fly, favouring particularly such clean stemmed forest as mopane.

One must not, however, be didactic on a question of this nature. As already stated, there is an optimum humidity for each species of tsetse, and information is available to show that, although the optimum humidity for *morsitans* is undoubtedly considerably higher than for *palpalis*, the humidity in very hot dry weather at low altitudes may be considerably below the optimum, leading to a decrease in the numbers of the fly at this period.

Whilst, therefore, in the wet and cool seasons thick vegetation is definitely avoided by *morsitans*, it does not follow

that it may not afford a welcome and even necessary refuge under the very hot and dry conditions, which occur seasonally at low altitudes.

It is clear, however, that, even granting such a dependence, the permanent elimination of undergrowth is not an undertaking which can be put rapidly into effect over an extended fly front.

Cutting down the bushes would merely have the effect of pruning them. Something considerably more drastic would need to be employed for lasting results.

This is one of the questions which might repay detailed investigation in reference to conditions in this Colony.

5. *Production of Thicket*.—The measure which is regarded as most promising against *morsitans* in Tanganyika at the present time is the exact opposite of the suggestion last considered, namely, to increase the undergrowth to such an extent that it forms extensive thicket.

It is the opinion of the Department of Tsetse Research that the open wooding which covers the greater part of that territory, as well as the Rhodesias and other States, is not really the natural climax vegetation of the country, but is a sub-climax, the vegetational succession being held at this point by the effect of grass fires. It is contended that, if grass fires are excluded, the succession will go forward to the climax, which is regarded as deciduous scrub, in the form of thicket. Experiments in excluding grass fires in certain localities have had the effect of greatly thickening scrub growth, and it would appear that, in regard to these localities at any rate, the reasoning has been correct.

I would state plainly that in my opinion this line of reasoning cannot be given general application, at least in Southern Rhodesia. There are no doubt places where thicket would occur but for the grass fires; in fact, I should have little hesitation in indicating certain areas of this nature. There are other places where exclusion of fire could not result in the production of thicket. I refer in the latter case to tracts of clean stemmed mopane forest, which bear no grass at all, and are, therefore, never traversed by grass fires even at the present time.

Thicket production is very dependent upon edaphic, that is soil conditions, and although certain types of thicket occur in poorly grassed areas, there are certain soil conditions which have the dual tendency to produce both thicket and long thick grass. Under such conditions the thicket growth is generally hampered and largely kept suppressed by the grass fires. Exclusion of fires in such localities would certainly result in the spread of thicket.

The Division of Forestry has certain limited tracts of forest in this Colony which have been protected from fire for up to twelve years, and I am informed that although the stand of trees is improving, there is as yet no indication of thicket formation.

By far the greater part of our *morsitans* area is dominated by either mfuti (*Brachystegia woodiana*) or mopane. The greater part of this forest is poorly grassed and contains few shrubs to constitute incipient thicket.

If after twelve years of fire exclusion we have not even got an obvious start towards a thicket, this measure cannot be said to very promising for general application.

Whilst, however, I do not think that mere release of the supposed succession by fire exclusion will result in a general solution of the problem, the question calls for careful investigation under our conditions.

There is the possibility of distributing the seeds of thicket forming shrubs in the selected belt of forest, and several other lines of investigation are worth exploring in this connection.

6. *European Settlement*.—Under this head, I need only say that European settlement, as it exists in this Colony, can only be effective as a barrier to tsetse in proportion to the distance to which the settlers keep game suppressed beyond the farms. Normally it does not protect itself and cannot persist in the face of advancing fly. In fact, the protection of such settlement constitutes our chief problem.

Apart from modification of the environment, the only alternative appears to be direct attack on the fly itself, under which head we may consider:—

1. **Biological Control.**—Control of insect pests by means of their natural enemies is a measure which appeals to entomologists and laymen alike. I have no time to go deeply into the question of utilising this method against tsetse fly, but would point out briefly that:—

- (a) Biological control can never result in total elimination of an insect pest, and
- (b) that tsetse flies are confined to Africa and have been in contact with their natural enemies for countless ages.

It is obvious that all these enemies working together are unable to control the fly.

It is just conceivable that a method might be discovered of modifying the environment in a way which would be inimical to the fly and favour its enemies, but this line of investigation is not regarded as very promising in itself. Modification of environment will, however, always have to be considered from the point of view of the fly's enemies as well as the fly.

2. **Traps.**—Traps may be directed either against the puparia (young stage of the fly) or against the adult flies.

Artificial traps for puparia have been experimented with most particularly in reference to *palpalis*, but have also received attention in reference to *morsitans*. They consist of suitable shade to entice the female flies to drop the larvæ. The puparia may be collected and destroyed at intervals, or a simpler method of destroying them may be used. The attraction exercised by prostrate tree trunks has been utilised in Tanganyika, trap trunks being laid on logs and at fixed intervals rolled from one side to the other so as to expose the puparia beneath to the sun, which tends to kill them. This measure necessitates removal of as many natural breeding sites in the locality as possible. Whilst such traps might be helpful in combination with other measures in suitable localities, there are obviously in general too many irremovable breeding sites available for more than partial success to attend this form of trapping.

As far as trapping the *adult flies* is concerned, Mr. Harris in Zululand was the pioneer of serious work along these lines, and has undoubtedly produced a trap which is very useful against *pallidipes* under Zululand conditions.

Unfortunately this trap, and every conceivable modification of it, has been tested against *morsitans* in most parts of Africa, including this Colony, and the verdict is everywhere the same, namely, that it does not catch this species in sufficient numbers to be of practical utility. Moreover, it is found that even against *pallidipes* its efficacy varies greatly with meteorological conditions, and it would appear that the Zululand climate is particularly favourable to its operation. It is reported, however, to be very effective against *palpalis* in Tanganyika.

The actual fact of the matter, in my opinion at least, is that a trap operating on the principle used, can only be effective against species of tsetse flies which are active during the daytime, and are very dependent upon shade. It is useless against *morsitans* in Southern Rhodesia, both in the wet season and in the cooler parts of the dry season. It is more effective in late August and September, and to a lesser extent in October, but even at best the traps tested did not average in 24 hours more than about the same number of flies which could be caught off man in the same locality with one net in one hour. In the wet season the average catch of the traps *in a month* did not exceed what could be caught off man with one net in one hour.

The question of trapping *morsitans* has received a great amount of attention in Tanganyika and many ingenious designs have been tried, but as yet we are without an effective trap for this species.

I am personally very anxious to continue experiments with traps, under suitable conditions for uninterrupted research in this Colony, although it is uncertain to what extent even effective traps could be used to advantage on the edge of our vast fly area.

In Zululand tsetse fly constitutes a sort of pocket problem compared with ours. I doubt if there are more than 500 sq. miles of fly infested forest concerned. The actual infested

area may be larger, but the distribution of the forest itself is patchy. Even so, over a thousand traps have been concentrated in and around the Umfolozi Game Reserve, which in itself is less than 100 sq. miles in extent.

It is to be realised that one cannot "trap out" limited portions of large *morsitans* areas and then proceed to the next limited area, without isolating these areas. The flies move about far too much for attempts along these lines to have any success. It would be necessary to attack a very large area at one time, which would mean a very large number of traps. To achieve what has been achieved by game reduction, namely, to arrest the spread of fly, by this means would obviously involve interminable and highly expensive trapping.

Any kind of traps would need protection from fire, and this, of course, is a considerable undertaking over large areas in this Colony.

I mentioned these points to illustrate some of the difficulties, not necessarily to condemn the possibility to making use of some effective type of trap against *morsitans* under certain circumstances, particularly in combination with other measures.

3. Poison Gas.—Calls for brief reference. Entomologists are so accustomed to using poisonous gases for the destruction of insects, that the possibility of using such gases against tsetse fly has, of course, been considered. It is not, however, considered that this measure holds out serious promise of feasibility, and no actual experiments have, to my knowledge, been carried out in the field.

One of the reasons is, of course, the danger to human life in releasing such gases in large quantities in the open. Another reason in some quarters is no doubt the fact that use of poison gas on a large scale would probably entail large-scale destruction of animal life, and cannot therefore be regarded as a substitute for game destruction.

Actually, however, the idea is ruled out on the basis of impracticability.

It is to be realised that in order to kill insects a definite minimum concentration of poisonous gas needs to be main-

tained for a definite period. Gas released into the atmosphere immediately becomes diluted with air, and even a heavy gas, such as *chlorine*, tends to diffuse comparatively rapidly. *Chlorine* has been tested against locust hoppers and grasshoppers in Russia and America respectively. It was found that, even working with such a heavy gas very close to the surface of the soil, and, of course, in a very limited area, the cost was too high for practical adoption of this method.

Tsetse flies do not live as close to the surface of the soil as locust hoppers, and the distribution of the gas would need to be correspondingly higher above the surface. Adult locusts will withstand an exposure of several minutes to chlorine at a concentration of 1:1000 in air, which is three times the concentration needed to destroy human beings. Flies, not tsetse flies, which we have tested, proved more resistant than locusts.

The figures with which one is confronted when considering use of poison gas against insects in the open air may be illustrated if we consider a concentration of chlorine of 1:1000 over one square mile to a height of ten feet.

From available information the cost of chlorine at, say, Salisbury would certainly not be less than 1s. per kilogramme. The cost in England is from 6d. to 1s. 2d. per kilo, apart from the cost of the cylinders containing it. Now, a kilo of chlorine makes about 12 cub. feet of gas at average temperatures. To cover one sq. mile, ten feet high at a concentration of 1:1000 of air, would require 278,780 cub. feet of chlorine, that is 23,232 kilos at 1s., amounting to £1,161 12s. 0d. To treat a small area of, say, 100 sq. miles, in this way would therefore cost over £116,000 for gas alone. It is to be admitted that at certain times of year it might not seem necessary to flood the whole area with gas, but complete results could hardly be anticipated from anything less.

What the effect of the procedure indicated would be I cannot say. I have used more or less arbitrary figures to illustrate in a general way the costliness of such attempt.

There are, of course, other gases more poisonous and suitable than chlorine—chloropicrin, the well known "tear gas," for instance—but increasing the poisonous nature of the gas means increasing the danger.

One must bear in mind also the fact that a limited treated area would not remain free from tsetse, even if the gas gave the desired effect. It would quickly be overrun by the fly again and all the work would need to be repeated.

In conclusion, I would express the hope that enough has been said to show that the Government in this Colony has had to take what may be regarded as emergency measures against the advancing fly, and that no alternative measure to game reduction has been feasible in the circumstances.

Now that we have reason to hope that effective control of the fly has been obtained, we are, however, in a position to consider the application of other measures with a view to maintaining this control and of reclaiming country from the fly, should this be considered feasible and necessary. In the meantime, however, we must not relax our grip of the situation.

The application of other measures must inevitably be gradual, and it would be no use to start developing a line of defence, which would take some years to become effective, if in the meantime the fly were allowed to continue to spread. Our line of defence would obviously soon be far behind the enemy's lines.

In the face of a position demanding urgent action, it is no use depending on research, which is unlikely to yield concrete results for a number of years.

Our present control of the situation makes the position particularly favourable for the prosecution of research with a view to finding feasible alternative measures applicable to this Colony, and free from the objections attending game destruction. For this purpose a properly equipped and staffed field research station is required.

Research should obviously go forward at the same time along two main lines, namely, in reference to (1) controlling the fly itself, that is, the entomological aspect, and (2) to immunising or otherwise enabling livestock to live in or on the margins of the fly areas, that is the veterinary aspect.

We are, of course, confronted with the difficulty that the financial resources of the Colony are limited, and that the

maintenance of control by present measures is already costing an appreciable sum annually. The cost of research would need to be added to this if disastrous advances of fly were to be avoided in the meantime.

Furthermore, it cannot be said that the prospect of discovery of alternative measures of fly control of general applicability is particularly bright in the present stage of development of the Colony.

In this connection it may, however, be pointed out that promising lines of research have a tendency to appear unexpectedly as one gains additional knowledge of any problem.

If such destruction of game as is being carried out is considered to be too obnoxious, then the Colony must be prepared to finance study with the object of finding an alternative. If a feasible alternative were discovered, we should all, I need hardly say, be only too glad to see the hunters' rifles exchanged for something else, capable of achieving the same end without destroying any wild animals.

Report of the Branch of Chemistry

FOR YEAR ENDING 31st DECEMBER, 1934.

By A. D. HUSBAND, F.I.C., Chief Chemist.

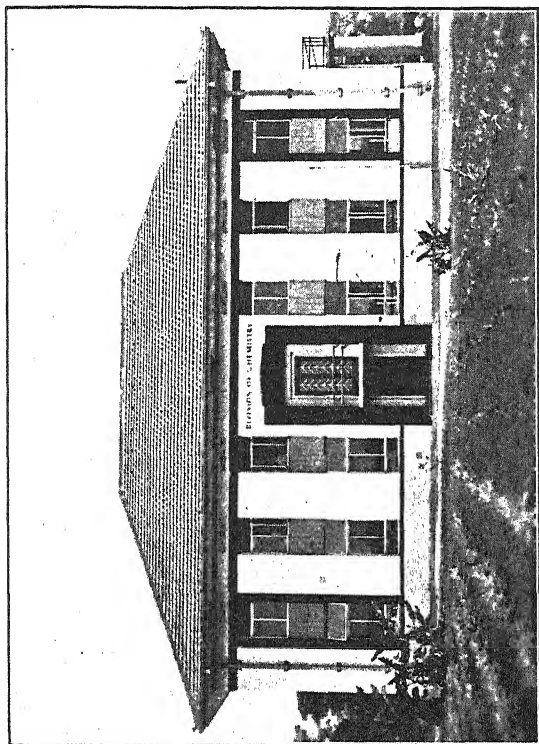
Accommodation.—For many years past reference has been made in the Annual Report of this Branch to the lack of suitable accommodation and the unsatisfactory conditions under which the analytical work has had to be carried out. It is now, therefore, with great pleasure that I have to record my appreciation of the excellent laboratories that have recently been provided. The new Chemical Laboratories which were completed in June last are probably as up-to-date as any in Africa, and will provide the necessary accommodation required for the satisfactory accomplishment of the chemical services required by the Colony for many years to come.

Great credit is due to the Public Works Department for the excellent manner in which the construction has been carried out and the laboratories arranged and equipped.

It is of interest that practically nothing but local material and labour was employed not only in the construction of the actual building but also in the benches, fume chambers, cupboards and other internal fittings.

The building has been erected on strictly utilitarian and modernist lines with a minimum of architectural embellishments and with no unnecessary decorative work inside.

Although the architects were confronted with many difficult technical problems, particularly in connection with water and gas supplies, ventilation and the disposal of



New Chemistry Building. Completed 1934.

drainage and sewerage, it is gratifying to record that all of these problems have been most satisfactorily dealt with, and I am glad to be able to place on record my appreciation of the careful consideration that was given by the Director and staff of the Public Works Department to the erection and equipment of the whole building.

General.—As in the past, the major activity of the Branch has been the accomplishment of the routine analytical work which it is called upon to perform.

A second important activity, and one which occupies a considerable portion of the time of the two senior officers of the Branch, is the rendering of advice on chemical problems by means of correspondence and interview.

In addition to analytical and advisory work in connection with agricultural problems, many calls are made upon this Branch by Government Departments, public bodies and private individuals for chemical services or advice on problems not connected with agriculture.

The ordinary routine work of the Branch consists of the following:—

1. Analyses of soils, manures, agricultural limes, waters for agricultural purposes, and general agricultural products.
2. Analyses of samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance."
3. Cattle dips and toxicological analyses for the Veterinary Department.
4. Analyses of samples and standardisation of glassware under the "Dairy Produce Act, 1925" and the "Dairy Industry Control Act, 1931."
5. Cleaning and treatment of tobacco seeds.
6. Advisory work by correspondence and interview.

Summary of Routine Samples.—The following comprises the samples analysed, or otherwise handled, during the year:—

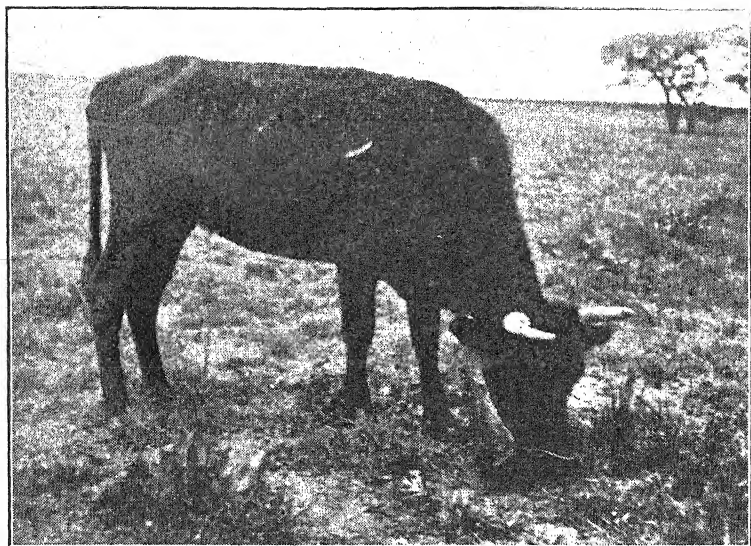
Soils	168
Manures and fertilisers	37
Farm foods	38
Cattle dipping fluids	25
Toxicological	89
Limes	7
Locust Spraying	35
Insecticides	4
Waters	8
Vegetable products	171
Dairy products	4
Tobacco seed samples	116
Miscellaneous	37
Research	554
	<hr/>
	1,293
	<hr/>

Soils.—Apart from the soils mentioned in the section of this report devoted to research work, 168 ordinary routine samples were dealt with during the year; 68 of these were sent in accompanied by requests from farmers for analysis and advice as to fertiliser treatment for flue-cured tobacco. It is significant that no advice about fire-cured leaf was asked for, although towards the end of the year some verbal advice was given.

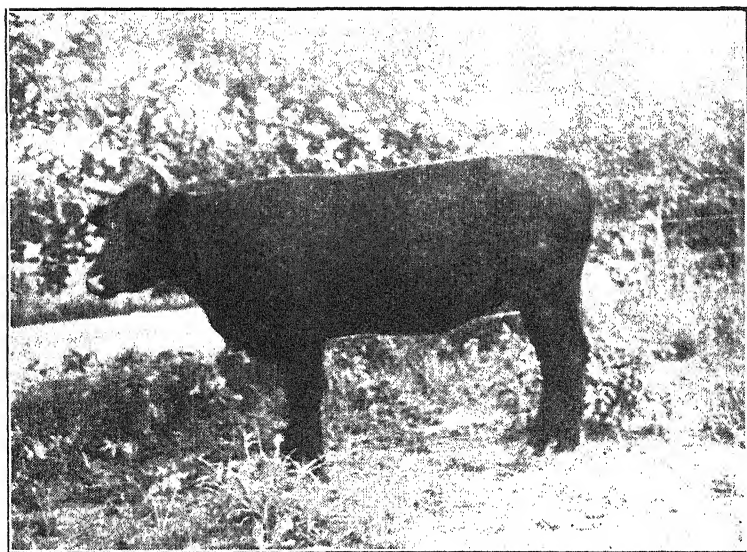
Four samples were subjected to mechanical analysis at the request of the Irrigation Division in connection with investigations on some effects of soil erosion.

The remaining 96 soil samples call for no special mention. They were subjected to analysis at the request of farmers and plot-holders seeking information as to their suitability for many different kinds of crops, vegetables or trees, usually with a supplementary request for manuring advice or general treatment.

Manures and Fertilisers.—The 37 samples under this heading include 27 taken under the “Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance.” All of the samples conformed to their guarantees within the limits of error allowed under the Regulations.



N.2.—Calved November 17th, 1933. Salt and iron commenced February 28th, 1934. Weight 535 lbs. Photographed February 28th, 1934.



N.2.—Weight when photographed December 19th, 1934, 750 lbs.
Note change of coat

Farm Foods.—These are 38 in number, which include 15 samples of meat, blood and bone meals, analysed for protein and oil contents for the Rhodesian Cold Storage and Export Company, in connection with its efforts to improve the quality of these by-products prepared in the abattoir. The installation of some new machines has effected a considerable improvement in lowering the oil content, thereby raising the protein content of these by-products.

One sample only was taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance," and was found to be up to registered strength in all particulars.

The other 22 samples were mainly those of feeding cakes and meals, including groundnut cakes, palm kernel cakes, velvet bean meals, germ meals, wheat screenings, etc. None calls for special mention.

Cattle Dipping Fluids.—Of the 25 items here, eighteen are samples of either dips or standard iodine from Cattle Inspectors throughout the country sent in for checking or standardisation according to the arrangements in force with the Veterinary Department for the past three years. It is rare now for any of these to be found seriously divergent from correct strength.

The remaining seven dipping fluids were submitted by private individuals for testing purposes, two being from a commercial firm with a view to future registration.

Toxicological Analyses.—The number of analyses (89) under this heading is comparable with that received over a long period of years, with the exception of last year, when it was almost doubled owing to special investigations mentioned in last year's Annual Report.

Eighty consisted of parts of the viscera of animals, mainly cattle, received for the presence or absence of arsenic to be determined. Fifty-one of these were positive and twenty-nine negative, indicating what has been remarked upon in previous years, that a dangerous negligence is still existent in the handling and use generally of arsenical cattle dips. When it is considered that these fifty-one represent possibly a very small proportion of the actual number of animals which have died from this cause, the loss to the stock of the country

through carelessness of this nature must be immense. Provided due care is given to the dipping of the animals and to the crude dipping solution itself, there is no reason whatsoever for this grievous loss which occurs year after year.

Three samples of water and one of scale were analysed with negative results for poisonous constituents; three specimens of animal viscera were examined for cyanide, also with negative results, one sample of sodium arsenite was submitted for strength testing, and a Laboratory Dip Tester was checked as to accuracy for the Chief Veterinary Surgeon.

Limes and Limestones.—These were seven in number, five being done for the information of the Treasury, Mafeking, and reported upon as to fitness for building purposes. The other two were local ones for agricultural purposes.

Insecticides.—The four samples tabulated under this head were all received from the Chief Entomologist in connection with his locust-killing investigations and were tested as to fineness of material, chemical composition and insecticidal efficiency generally.

Waters.—Four of the eight samples of waters were investigated for a firm in the Bechuanaland Protectorate and reported upon as to suitability for watering cattle; three others for irrigation purposes, and the remaining one for boiler-feed use.

Vegetable Products.—Fifty-three from the 171 items under this head consisted of samples of tobacco leaves received from the Plant Breeder, Tobacco Research Station, Hillside, and were analysed fully for his information. The nicotine and moisture contents of three others were determined for commercial firms.

Sixteen samples of silage were analysed for the Manager, Salisbury Experiment Station, and analytical comparisons of feeding values with molasses treatment and without were obtained. It was found that molasses produced no significant or even appreciable improvement in feeding value.

Sixteen samples of different varieties of pure grasses and hays received complete analyses, some at the request of farmers, others for our own records; the Empire Cotton

Growing Corporation, Gatooma, received results of complete analyses of sixteen different cotton plant samples differentiating between complete bolls, stems and branches, leaves and young growth, and the moisture and protein figures for 67 varieties of wheat were obtained for the Plant Breeder.

Dairy Products.—Four samples only were dealt with during the year, three of them being received from the Chief Dairy Officer and analysed for him to assist in certain of his investigations. The other was a sample of standard soda tested for strength at the request of a commercial firm.

In addition, standard soda solution has been prepared and despatched on request to dairy farmers throughout the whole country to be used in acidity tests in milk, cream and whey. In all, 120 pints have been sent out, in addition to unrecorded quantities for the Dairy Officer and his staff.

Tobacco Seed Samples.—The 116 samples enumerated under this heading amount to more than twice the number treated last year, and during the months of August, September and October, the work involved occupied almost the full time of one of the officers of the Branch. Over 200 lbs. of seed were dealt with in the course of the year.

Miscellaneous.—These thirty-seven entries show much variety. Six were samples of Neat's Foot Oil analysed for the Bulawayo Cold Storage and Export Company, Limited, to assist them in their attempts to improve the quality of this product. In addition, and for the same purpose, two samples of Premier Jus, one of dripping and one of tallow were investigated for this Company, also a sample of Cleaner and Cleanser

Four bitumen specimens were analysed for the Chief Road Engineer, to ascertain the best material for road-making work. Four quantities of oxide of iron were examined for farmers in connection with feeding of mineral supplements to cattle, and four samples of soap were tested for commercial firms to check compliance with the terms of the "Soap Standardisation Act."

Two small consignments of alcohol and petrol-alcohol mixture alleged to be injurious to motor car engines were

examined, and the cause of trouble was believed to lie in the denaturing agent. Two samples of oil from suction-gas engines were tested to ascertain whether any connection existed between the oil and trouble that was being experienced in the engines. The results of the analyses showed that the oil was faultless.

Work for other branches of the Department included the calorific value of a wood for the Forest Officer, investigation into impurities in spray-pumps for the Chief Entomologist, examination, analysis and preparation of solutions for the Director of Veterinary Research. In addition, three disinfectants for a commercial firm were dealt with, two experimental samples of papain from paw-paws in the Macheke district and one of woodash for the Mazoe Citrus Estate.

Two samples of renal and urethral calculi were forwarded from the Melsetter district for chemical identification. These had been observed previously as the cause of death of animals by obstructing the urethral passage and so causing rupture of the bladder. Chemical tests indicated conclusively that these calculi were almost entirely composed of Xanthine.

The occurrence of Xanthine stones in man or animals is extremely rare, and is indicative of some disturbance in the protein metabolism. In human beings, Xanthine stones usually occur as a result of direct metabolic disturbances caused by diseases of the liver such as "yellow atrophy."

I have been unable to find any references in the literature to Xanthine stones in cattle, although the occurrence of such stones in sheep has recently been reported in, I believe, an Australian agricultural publication. In this case the causative factor is thought to be phosphorous deficiency in the pasture on which the sheep graze. No previous cases are on record of cattle having died in this Colony as a result of Xanthine stones, but the owner of the cattle in the present case stated that he loses a number of beasts each year from this cause.

As the occurrence of these stones is a matter of some interest, it would appear desirable that the problem should be further investigated as, if the cause in this instance could

be traced to a mineral deficiency, the information obtained would be of considerable practical importance as well as of scientific interest.

Twenty-seven samples of faeces from sheep were examined for Mr. L. E. W. Bevan, Beit Research Worker in Trypanosomiasis, for whom temporary accommodation has been provided at these Laboratories. Mr. Bevan was anxious to ascertain the effects of the iron-copper-salt and other licks upon the course of trypanosomiasis in animals, and especially upon those inoculated by his method which sets up an "immunity-tolerance" in the treated animal. Past experience has shown that this "tolerance" may break down under adverse conditions of which nutritional deficiency is one. Knowing the beneficial results obtained by the provision of the iron-salt lick to cattle at the Pasture Research Station, Marandellas, he considered it desirable to ascertain whether similar results followed its administration to animals suffering from the anaemia associated with trypanosomiasis. The results proved of considerable interest and revealed the fact that the iron was readily assimilated and probably stored in the blood-forming organs, little or none being found in the faeces of sheep receiving a regular supply of the lick daily for over three months. The beneficial effects were manifested by the amelioration of the disease in the treated animals and by the high haemoglobin content of their blood as compared with the controls receiving no lick. The latter, on the other hand, developed a "salt craving" and pica and consumed quantities of soil containing iron, which was found in appreciable quantities in their faeces.

RESEARCH.

A. **Soil Investigations.**—(a) 431 of the 554 research items were soil samples taken from the Salisbury Experiment Station for analysis in connection with research into the effect of nitrogenous fertilisers on green-manured land. The object of the research was to attempt to ascertain the effect of different nitrogenous fertilisers on (i.) the carbon-nitrogen ratio of the soil, and (ii.) the yield of maize.

A rectangular area of three acres was green-manured with sunnhemp in January, 1933, and after this had been ploughed

in a basal dressing of 200 lbs. per acre raw rock phosphate was given. The area was sub-divided into thirty one-tenth acre plots and, on a randomised arrangement, six of these received 100 lbs. sulphate of ammonia per acre, six 200 lbs. per acre, six 100 lbs. bloodmeal and six 200 lbs. bloodmeal, the remaining six being retained as control plots. Maize was planted at the normal time.

Fourteen samplings in all of each plot were made throughout the year, commencing at twenty-one day intervals but lengthening as the season and the maize matured. These samples were analysed for nitrate nitrogen, total nitrogen, and carbon—the results being tabulated and graphical representations drawn. The maize was reaped at the usual period and yields from each treatment recorded.

The carbon-nitrogen ratios commenced at approximately 12:1, widened to almost 14:1 at the height of the growing season in January-February, remained almost constant at this point until the commencement of the rainy season 1934/35, and then finally dropped to 12.5:1—a little higher than at the commencement, on its anniversary. This bears out the results obtained at Rothamsted, where it has been found that fertiliser treatment is ineffective in altering the carbon-nitrogen ratio; however this be disturbed, it always comes back to its normal value.

No significant difference in the carbon-nitrogen ratios of the soils subjected to the different treatments was observable throughout the year.

The yield of grain and also of stover was highest on the plots treated with 100 lbs. sulphate of ammonia per acre, but when subjected to statistical analysis, there was no significant difference.

Before definite conclusions could be made as regards the response to these treatments in the particulars mentioned, it would be necessary to carry out the tests for at least a period of three consecutive years. The expense involved, however, in purchasing the necessary chemicals for the analysis required is at the present time prohibitive within the limits of the Vote allowed to this Branch.

(b) Four samples from a non-green-manured section were taken to test the nitrifying capacity of the soil used in the above piece of research, with particular regard to its nitrification of bloodmeal and sulphate of ammonia. This was done by incubation for a month at a constant temperature of 35°C. At the end of the first month it was found that nearly twice as much bloodmeal as sulphate of ammonia had been nitrified, so this being contrary to expectations, the experiment was repeated. Similar results were again obtained, with even a higher proportion of nitrification of the bloodmeal than the sulphate. Another repetition with the addition of carbon in the form of cane sugar gave practically identical results with the second. This experiment is again under way with the soils exposed to natural conditions, but results are not yet to hand.

(c) Two soil horizons were sampled for the study of soil profile development, twelve samples coming from the red dolerite soil at the Experiment Station and five from the brown soil of the Eastern Commonage. The study of the origins of the mature surface soil from the parent rock, through the intervening developing layers, is still being pursued.

B. Green-manuring: Sunnhemp.—With a view to ascertaining the optimum time for ploughing in a green crop of sunnhemp, samples were taken each week from the last week in January to the first week in April, and an analysis of their nitrogen, carbon, potash, phosphoric oxide and fibre contents was made. The first samples were taken just before flowering commenced and the last when practically all the seed had set. Samples of the complete plant, plant without roots, and roots alone, were analysed in each case—in all twenty-nine samples being taken.

An examination of the results of analysis shows that the nitrogen, potash and phosphoric oxide values dropped, the fibre increased and the carbon-nitrogen ratio widened up till the middle of February, after which they remained fairly constant until near the end of March, when the nitrogen, potash and phosphoric oxide again dropped, the fibre increased and the carbon-nitrogen ratio widened.

The general conclusion to be drawn is that the ploughing in of sunnhemp should be carried out as soon as possible after flowering has commenced and a sufficient bulk has grown to warrant the crop being turned in.

C. Papain Investigations.—These were undertaken on three samples of the pure product with a view to increasing our information on the analysis and properties of this comparatively little known enzyme, the production of which may become a commercial proposition in this Colony in the future.

D. Locust Spraying.—This heading is used to designate the work done by this Division in collaboration with the Entomological Branch during the latter's experiments with the destruction of locusts by spraying arsenic from aeroplanes. Locusts subjected to the spraying were tested for the presence of arsenic, and, later on in the year, vegetation from the areas involved in the operations were analysed and reports issued as to safety or otherwise for grazing animals. By the end of the first month of the rains all areas were found to be clear of poison. In all twenty-four sample numbers come under this section.

Detailed reports upon this work were submitted to the Secretary, Department of Agriculture and Lands and to the Chief Entomologist, and were subsequently published in part in the Proceedings of the Third International Locust Conference, London.

Mineral Feeding Experiment with "Professor Wendt's" Mineral Lick.—At the request of the Secretary, Department of Agriculture, an experiment was laid down on the Pasture Research Station to test the efficacy of a mineral lick devised by Professor Wendt in Germany, which is known as Professor Wendt's "Iodate Mineral Salts." Many advantages in connection with the health, fertility and productive capacity of animals receiving this lick are claimed by its originators and it was desired that its efficacy should be tested in this country.

Owing to the fact that the experiments being carried out at Marandellas had shown that the major deficiency occurring on this Station is that of chlorine, it was not considered advisable to carry out the experiments with animals at this Station, as Professor Wendt's lick contains no chlorine and

beneficial effects could not be expected from the feeding of any minerals until this chlorine deficiency was corrected. It was, therefore, decided to carry out tests with the lick at Matopos, where no chlorine deficiency has ever manifested itself among the grazing animals.

Twelve yearlings, all of which had been born on the Station, were accordingly picked out and were divided into two groups of six, each group of animals being as comparable in age and weight as possible. One group was kept as a control and each animal in the other group received a daily dose of the mineral lick in accordance with the recommendations made in a memorandum supplied by the agents for the lick in this country.

The animals receiving the lick were dosed individually each day by placing the requisite quantity of the lick on the back of the tongue. Both the groups were kept together in a paddock and were fed hay *ad lib*.

The feeding of the lick was commenced on the 25th June and was continued until the 30th November, when the quantity supplied by the agents for the experiment was all used up. The animals in each group were weighed fortnightly and the total fortnightly weight of each group has been charted in the attached graph, from which it will be seen that the feeding of the salt lick has apparently exercised no influence on the weight of the animals receiving it. Although no lick is now being fed to the "salt" group, observations upon them are still being continued in order to ascertain whether any beneficial influence will be seen in the subsequent development of the animals now that they are on fresh green grass.

RESEARCH INTO THE IMPROVEMENT OF NATURAL PASTURES: PASTURE RESEARCH STATION, MATOPOS.

During the seasons 1931/32 and 1932/33 severe droughts were experienced on this Station which have seriously affected the grazing on the heavy black soils. Although at the commencement of the experiment in 1929/30 and also during the season 1931, excellent yields of hay were obtained on this black land section amounting on the average to 1,690 lbs. per

acre per annum, the yields dropped as the result of drought to 215 lbs. per acre in 1932, to 560 lbs. per acre in 1933 and to 503 lbs. per acre in 1934.

Although the total rainfall on this Station during the year 1933/34 amounted to 18 inches, the incidence of the precipitation was extremely erratic, and no sooner did the grass begin to green up and grow than a drought period followed sufficient to burn up the grass and to destroy any fresh young shoots that had sprung up.

At practically no period after the first month of the season was the grass on this black land section green in colour, and it invariably had a scorched brownish appearance. Numerous cracks, an inch or more wide, were apparent all over the soil during the greater part of the season and exposure of the roots of the grass in these cracks led to many plants being destroyed. It is not surprising, therefore, that the "mat" as well as the yields of hay has been seriously affected by the successive droughts.

The influence of the fertiliser treatment accorded to these black land paddocks has been largely masked by the drastic effect of the three years' drought, although during the first two years of the experiments, when the rainfall was good, it was evidenced that the yields of hay on the paddocks to which nitrogen had been applied, were markedly increased.

It was stated in my Annual Report for 1933 that the sandveld section at Matopos did not suffer nearly so much from the effects of the droughts as the more fertile black land. This is again apparent during the season 1934. The average yield of hay per acre over the whole of the sandveld hay section amounted to 887 lbs. per acre as against the 503 lbs. obtained on the black land.

It is interesting to note that the average yield of hay on the sandveld section has increased from 668 lbs. per acre in 1931 to 887 lbs. per acre in 1934, whereas the black land has decreased as a result of the droughts from 1,550 lbs. per acre in 1931 to 503 lbs. in 1934.

It is extremely noticeable even in the field how quickly the sandveld responds to even light showers of rain which

have no visible effect on the heavy black land. The "mat" on the sandveld paddocks has considerably improved despite the fact that during the drought years it was even more heavily grazed than the black land paddocks. The results of the experiments at Matopos have already given ample evidence that, although in seasons of good rainfall the heavier clayey lands are more fertile and give good yields of better quality hay than the sandveld, the latter type of land will stand up much better to adverse weather conditions, improves much quicker by controlled grazing and cutting, and responds more readily to fertiliser treatment.

Results of Analyses of Hay Samples.—Altogether twenty-one samples of hay were analysed from this Station; twelve being taken from the black land and nine from the sandveld.

Black Land.—An examination of the results of analyses shows that the fertilised paddocks have yielded an appreciably better quality hay than the unfertilised control paddocks.

The mean value for crude protein from the fertilised paddocks was 5.6% and that from the control 4.3%. The phosphoric oxide content shows up in much the same way, while the potash and chlorine values are both highest in the N.P.K. hay. All the hay was of good quality and closely comparable with that cut in 1933.

It should be noted here that although no significant differences in the yields of hay were apparent from the fertiliser treatment accorded to the various paddocks during the first three years of the experiments, a marked effect on the feeding value is now making itself apparent as a result of the fertiliser treatment given in previous years.

Sandveld.—On this section also the hay from the fertilised paddocks had a better feeding value than that from the control. The hay from the paddock that had received dressings of a complete fertiliser was superior to that of the hay from the paddocks dressed with superphosphate, rock phosphate, or superphosphate and potash, but all the fertilised paddocks gave hay of superior quality to the unfertilised paddocks. The most marked difference in the hays was in their content of crude protein.

Experimental Animals, Matopos.—Despite the drought conditions that have prevailed on this Station for the past three years, the condition of all the animals still remains excellent. Owing to the scarcity of the grass on all the experimental paddocks, it was found necessary to cut grass on every possible piece of available land allotted to the Station in order to obtain a sufficiency of hay to carry the stock through the winter months. All the calves and yearlings were kept on the experimental area right throughout the year, but the breeding cows were turned out to graze on the land from which the supplementary hay had been cut. By adopting this procedure all the animals were kept in excellent condition. The fertility of the cows on the Station continues to be exceptionally high, and it is anticipated that all the cows will again calve during the present season.

Fifteen steers bred on the Station were sold to the Rhodesian Export and Cold Storage Company and were sent overseas as "chillers." These animals averaged approximately three years of age and were "topped off" for a period of four months. An excellent report regarding their condition was received from the Cold Storage Company, and the average price received for the animals was £7 13s. 10d. per head.

PASTURE RESEARCH STATION, MARANDELLAS.

Rainfall.—The total rainfall on this Station for the season 1933/34 was 24 inches. The wet season started well, and up to the end of January 17.2 inches was recorded. After that there were serious drought periods, one of 25 days, *viz.*, from the 13th February to the 9th March, during which only 0.18 inches fell, and another of 27 days, from the 13th March to the 8th April, when only 0.57 inches fell on seven separate days. The rainfall in February, March and April was just over two inches in each month.

Yields of Hay.—As was to be expected, the drought periods in February and March seriously affected the yields of hay on those paddocks which were grazed early in the season and then mowed at the end of March.

Although no fertiliser was applied to any of the paddocks during the season 1933/34, it will be seen from the following

figures that there was a considerable residual effect from the fertiliser treatment that had been accorded to the paddocks during the previous three years.

For the purpose of comparison, the average yields of hay per acre per annum for the first three years of the experiments are also given.

Yields of Hay per Acre.

Season.	Nitrogen, Phosphate, Potash. (N.P.K.)	Phosphate and Potash: (P.K.)	Superphos- phate: (P.)	Raw Rock Phos- phate.	Control.
1934... ..	1225lbs.	1009lbs.	1035lbs.	844lbs.	703lbs.
1931-33 ...	1445lbs.	1042lbs.	937lbs.	756lbs.	820lbs.

Results of Analyses of Hay Samples.—Eighteen samples of hay were analysed from this Station, and the results showed that in general a good quality hay was obtained. A study of the analytical data fails to indicate any effects due to fertiliser treatment, nor is there any great difference between the samples taken from hay cut in February and from that cut in March. Compared with the analyses of the 1933 hay, the results are, in general, lower. This is probably due to the mowing being slightly later in the season.

Compared with hay from Matopos, the Marandellas hay may be said to be intermediate in feeding value to the hays obtained from the black land and sandveld sections at Matopos.

As has been pointed out before, the most striking difference between the hays from Matopos and Marandellas is in the chlorine content, the hay from the black land on the former Station containing double that from the sandveld at Marandellas.

It is interesting to note here that despite the adverse effect of the short rainfall in the latter part of the wet season on the paddocks reserved for late hay cutting, the total yields of hay on all the paddocks, with the exception of the N.P.K. and control, were well up to the average of the three previous years.

As sulphate of ammonia is utilised very quickly when applied to grassland, it would be expected that the yields of

hay would drop on paddocks in years when no nitrogen was applied, therefore the decreased yields from the N.P.K. paddocks is easily explicable.

The point of interest in connection with these hay yields is that despite the relatively unfavourable season, the yields of hay are well up to average on all the fertilised paddocks, but have fallen on the unfertilised control paddocks. This can be seen particularly well by a study of the yields obtained on the raw rock phosphate paddock and the control. The yields on the former have always been lower than those on the latter, owing to a slightly poorer inherent fertility, but during the past year the yield obtained from the raw rock phosphate paddocks was actually greater than in former years, whereas the yield from the controls decreased.

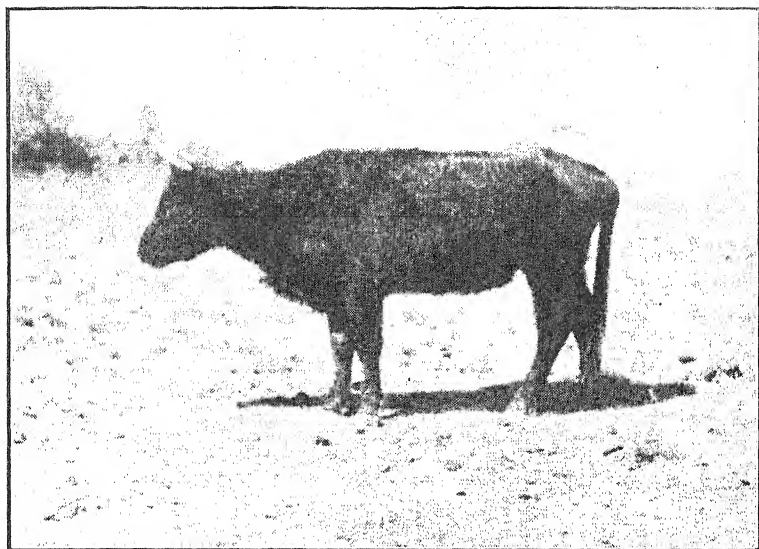
This result substantiates the statement made in the Annual Report last year that adverse climatic conditions exercise a much more marked effect on unfertilised than on fertilised pastures.

Experimental Animals, Marandellas.—In my Annual Report for the past two years reference has been made to a condition of malnutrition occurring among the breeding cows on this Station, for which the name of Nutritional Anæmia was coined. Although this condition has only been visibly manifested in the breeding cows, it undoubtedly occurs to a greater or lesser degree in all the animals on the Station.

The condition is characterised in the breeding cows by a rapid and progressive emaciation commencing immediately after calving, loss of appetite and the development of a harsh, staring coat. The cows make very little udder and the milk yield is very low.

These symptoms occur not only in cows calving during the latter part of the wet season, but also in those calving in the early part of the wet season when the grass is at its best from a nutritional point of view.

The condition was first noted to occur in the breeding cows in the control group which were grazing on unfertilised pastures, but later on it was noted in practically all the breeding cows, and the symptoms were just as marked in cows grazing on partially or completely fertilised pastures as on



N.3.—Calved November 4th, 1933. Salt and Iron commenced May 23rd, 1934 Weight May 23rd, 1934, 637 lbs. (Note harsh, staring coat.)



N.3.—Photographed January 4th, 1935. Weight 804 lbs.
(Note shedding of coat.)

those unfertilised. In order to obtain further information regarding the onset of this condition, the whole plan of experiments previously laid down on the Pasture Station was considerably modified.

As this condition did not occur among the breeding cows at Matopos, a careful study was made of the data obtained by chemical analyses of the grasses from the two Stations. In general, the chemical composition of the grass at Matopos is very similar to that at Marandellas, the only really marked difference being that the former is very much richer in chlorine and iron.

It was thought, therefore, that the condition of nutritional anæmia occurring among the breeding cows at Marandellas might primarily be due to a deficiency of chlorine in the grass, as without an adequate supply of chlorine the animals would be unable to secrete a sufficiency of hydrochloric acid in their stomachs to afford proper digestion. This theory would seem to explain the loss of appetite in affected animals and their failure to thrive even when ample green grazing was available to them. An experiment described in my last Annual Report demonstrated that the addition of iron alone to the diet of affected cows apparently failed to effect any improvement, hence the onset of the condition of anæmia could not be attributed solely to an iron deficiency. The occurrence of anæmia in cattle and sheep is very widespread, and the condition has been variously described as "Bush Sickness" in New Zealand, "Nakurutis" in East Africa, "Pining" in Scotland, "Denmark Wasting Disease" in Australia, and "Salt Sick" in Florida. In some cases a cure has been effected by the administration of iron compounds alone and in others iron has been given in combination with salt and other chemicals. As the symptoms of "Salt Sick" described by Becker, Neal and Shealey in Florida are very similar to those occurring in the Marandellas cattle, it was decided to use their lick in the experiments to be carried out on the Marandellas cows. This lick is composed of 100 parts of salt, 25 parts of red oxide of iron and one part of copper sulphate. The cost of this lick works out at about 13s. 7d. per 126 lbs. and the approximate quantity consumed per cow per day when allowed free access to the lick is three ounces.

This cost could be considerably reduced were it possible to obtain iron oxide at a more reasonable figure than that obtaining in Salisbury at the present time. The high price of the iron oxide is largely due to the high cost of railage, which is approximately £9 17s. 6d. per long ton from Beira to Salisbury, and nearly £25 from Durban to Salisbury.

A plan of experiments was devised utilising the same animals as had been used in the previous experiments which were laid down in 1929 to test the influence of fertilisation of the pastures on the health, rate of growth and general productive capacity of grazing animals.

At the time the new experiments were commenced the old control group of animals was undoubtedly in the poorest condition. They were, therefore, supplied with salt lick composed of salt, iron oxide and copper sulphate; the group of cattle grazing on the paddocks fertilised with superphosphate in the previous experiments was given salt alone; the raw rock phosphate group of cattle was given a lick composed of equal parts of the salt and iron lick and bonemeal, and to the animals grazing on the completely fertilised paddocks no lick was given.

Results of Mineral Feeding.—Improvement in the condition of all the cows being fed the mineral licks, whether composed of salt alone, salt and iron, or salt, iron and bonemeal, was rapidly apparent. The appetites of all the animals improved considerably as well as their general condition.

The old control group of animals which is receiving the lick composed of salt, iron and copper sulphate, was soon outstanding and their condition even at the end of the dry season was, comparatively speaking, excellent; the animals receiving salt alone are also in good condition, but are not up to the standard of those getting salt and iron. The group receiving bonemeal in addition to the salt and iron was not in nearly such a good condition at the end of the dry season, but this is probably due to the fact that the condition of the animals had gone down considerably while being given iron alone before they were placed on the complete lick. On the other hand, the cows in the N.P.K. group, which are grazing on completely fertilised pasture but which are receiving no

salt lick whatever, were in a wretched condition at the end of the season and the symptoms described above were apparent in all of the cows in this group which had calved during the previous season. Two cows out of the four that calved in this group were in such an extreme state of emaciation a few months after calving that it was extremely doubtful whether they would live.

As both animals calved in November and ample grazing was available, their condition could not be ascribed to general lack of feed. One cow (N2) shortly before calving on the 17th November, 1933, weighed 730 lbs. and on the 28th February, 1934, her weight had dropped to 535 lbs.; by this time she was so weak that she could hardly stand, and was being badly gored by the other animals.

It was decided, therefore, to remove her and her calf to a separate paddock and to feed her the salt and iron lick. The result was astonishing, and within seven weeks, although still feeding her calf, she put on 100 lbs. in weight and took on an altogether new lease of life. She was successfully carried through the dry season on hay alone, and on the 19th December, 1934, she was returned to her group weighing 750 lbs.

The second cow (N3) which at the time of calving on the 4th November, 1933, weighed 720 lbs., dropped to 637 lbs. by the 23rd May and was in a very weak and emaciated condition.

This cow was also put on to salt and iron and rapidly improved in condition; she was returned to her group on the 4th January, 1935, weighing 804 lbs.

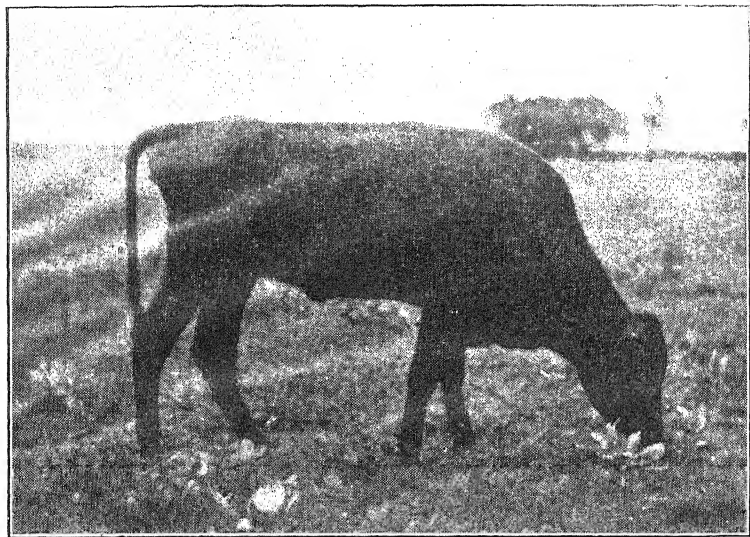
Photographs of these animals are appended, together with those of two heifers born on the Station which have just calved. Prior to calving, both heifers appeared to be in very good condition and visibly there was nothing to choose between them. The photographs were taken eight days after calving, and it will be seen that already a difference exists in their general appearance. N11, which has been running all her life on completely fertilised pastures, is rapidly falling off in condition and, as is shown in the photographs, has made practically no udder. C10 was an exceptionally small calf when born and her dam belonged to the group grazing on

unfertilised paddocks. During the first eighteen months of her life C10 had a considerable set-back and was in the group that first exhibited marked signs of malnutrition. On the 17th February, 1933, this heifer was put on to salt and iron and she has had constant access to this lick ever since. It will be seen from the photograph that although still a small animal with a good proportion of Hereford blood in her, she has nevertheless made an excellent udder and is in excellent condition after calving. An interesting and important point in connection with the feeding of the salt and iron lick is the effect on the fertility of the cows. The first season after the mineral feeding was commenced, nine out of ten of the cows in the group receiving salt and iron calved down, and already this season most of the cows have calved again, and it is certain that ten out of the eleven cows in this group (one heifer having been added) will calve before the end of the season.

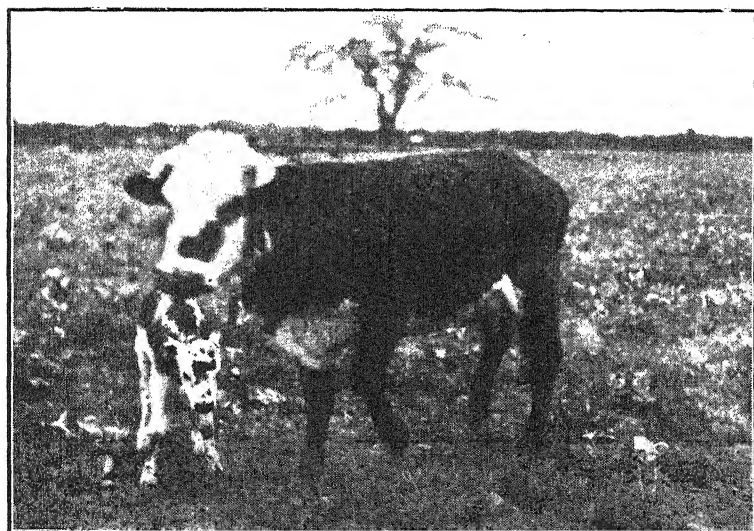
In the group receiving salt alone, the percentage of calving during the first year was only 67%, and will not be more than 56% during the present season. In the group receiving no mineral lick the percentage calving last season was only 44%, and it is doubtful whether it will exceed 37% during the present season.

An additional point noted was the effect of the feeding of the minerals on the milk yields of the cows. Although none of the animals on the Station are generally milked, it is evident from the size and condition of the udders of the cows that a marked effect on the milk yields has resulted from the feeding of the salt or salt and iron. Every cow in the salt and iron group which has calved has had to have milk taken away from her during the first week after calving to relieve the distension of her udder.

In addition to improving the condition of the cows and their fertility, the results so far obtained indicate that the feeding of the salt and iron lick will materially influence the rate of growth of the calves. The average weight of the calves at birth in the salt and iron group was 73 lbs. as against 67 lbs. in the group receiving salt alone and 68 lbs. in the group receiving no minerals. At the end of the six months the average weight of the calves was 329 lbs. in the salt



N.11.—Born September 21st, 1931. Calved December 11th, 1934. Weight before calving 768 lbs. Weight 8 days after calving 574 lbs. Photographed December 19th, 1934.



C.10.—Born September 12th, 1931. Calved December 11th, 1934. Weight before calving 654 lbs. Weight 8 days after calving 609 lbs. Photographed December 19th, 1934.

and iron group, 234 lbs. in the salt group and 270 lbs. in the non-mineral group. At the end of eleven months the weights were 356, 316 and 283 lbs. respectively. The weights of these animals will continue to be recorded and will be reported upon at a later date.

Although the above results are extremely interesting and have demonstrated conclusively the beneficial results obtainable from the feeding of salt and iron to animals grazing on sandveld pastures similar to those obtaining in the Marandellas district, it is considered that an attempt should be made to obtain more detailed and scientific information regarding the influence of the lick on the general metabolism.

It is hoped that during the coming year sufficient funds will be available for the purchase of a metabolic cage suitable to take a cow in order that affected and non-affected cows may be placed in it and the chlorine and protein metabolism followed.

Revenue.—The total revenue obtained from the Pasture Research Stations during the year ended 31st December, 1934, was as follows:—

Sale of steers	...	...	£154	1	1
Sale of sheep and wool	...	...	42	9	8
Sale of hay	...	...	21	0	0
Dipping fees	...	...	7	16	5
			<hr/>		
			£225	7	2
			<hr/>		

Sheep.—In January, 1932, a loan was obtained from the "Sheep Experiment Fund" for the purchase of fifty merino ewes and two rams from the Union of South Africa for the Marandellas Pasture Station. The object in purchasing the sheep was to ascertain whether they could successfully be run under the system of veld control which is being practised on the Station. The sheep are allowed to graze over the paddocks following the cattle, and in addition the ewes are provided during the lambing season with a small quantity of green oats which are grown in the vleis. A small area of land is sown each year with teff, which is cut for hay and fed to the sheep during the winter months.

All of the sheep are provided with a salt lick composed of bonemeal, salt, sulphur and ferrous sulphate. They are all regularly dosed and enema treatment is given about twice a year, as it was found that this was the only effective manner of dealing with nodular worms, which were very prevalent among the sheep during the first few months that they were on the Station.

The original sum borrowed from the "Sheep Experiment Fund" was £65 4s. 2d., and all of this, with the exception of an amount of £11 2s. 11d., has now been repaid by sales of lambs and wool. The nett proceeds obtained from the sale of the wool from the sheep in 1933 was £19 9s. 8d. The money derived from the 1934 wool crop has not yet been received, and it is anticipated that when this amount comes to hand it will more than pay off the balance due on the original loan. At the moment there are eighty-two sheep on the Station, which is an increase of approximately 60% on the original number purchased.

Publications.—A complete list of analyses of Rhodesian foodstuffs compiled from results obtained in the Laboratory over several years was published in the August number of the *Rhodesia Agricultural Journal*.

Staff.—No changes have taken place in the Laboratory staff, which has been at full strength throughout the year.

Geophysical Prospecting for Water in Southern Rhodesia.

Geophysical prospecting methods have been extensively studied in recent years, and as they are essentially methods of determining the underlying geological structure, are now largely utilised in the preliminary investigations of new areas in order to define the most suitable sites for boring, to prove the existence of mineral reefs or underground water supplies.

The success which had attended the investigations of the Imperial Geophysical Experimental Survey in connection with the development of underground water supplies in Australia drew attention to the possibility that a similar investigation in this country might be of value in certain of our difficult areas.

The Government was fortunate in obtaining the services of Mr. S. H. Shawe, of Birmingham University, and to have available Mr. J. C. Ferguson, of the Geological Survey, to carry out the investigation, as both of these gentlemen had previously been associated with the Experimental Survey in Australia.

A report was submitted to the Government in due course and sites selected for trial boreholes in the Nata Reserve, which were later bored on and good supplies developed at the approximate depths anticipated.

In view of this encouraging result the electrical apparatus has been purchased by the Government and additional investigations are being carried out from time to time by a member of the Irrigation Division under the guidance of Mr. J. C. Ferguson. Mr. S. H. Shaw recently read a paper on the subject before the Institution of Mining and Metallurgy in London, and the following extracts from this paper are, with Mr. Shaw's permission, reprinted in this *Journal*, as they may be of great interest.

Introduction.—This paper gives an account of the application of the resistivity method of geophysical prospect-

ing to certain water-supply problems in Southern Rhodesia, and of the results of subsequent boreholes put down to check the electrical work. The tests were carried out during July and August, 1933, for the Irrigation Division of the Department of Agriculture and Lands, and I am indebted to the Southern Rhodesian Government for granting permission for publication of the results in this paper.

The object of the tests was to see whether geo-electrical methods would be of assistance in the selection of drilling sites for the development of water supplies in the more arid parts of Southern Rhodesia. The Irrigation Department has been engaged for some years on an extensive drilling programme in the Native Reserve Areas with the object of supplementing the existing, and often scanty, water supplies. Over large areas of Matabeleland the country is very flat, geological exposures are infrequent, and detailed topographical and geological maps are not available. In such circumstances the discrimination between successful and unsuccessful sites for boring is a particularly difficult matter.

The area chosen for the trial was part of the Nata Native Reserve, in the Bulalima-Mangwe district, some sixty miles west-north-west from Bulawayo. Here the Irrigation Department had already completed twenty-four boreholes, so that a considerable amount of geological information was available for checking the first electrical measurements. The general conditions, also, were representative of considerable areas of the country.

Nata Reserve. Geology and Water Supplies.—The resistivity tests were carried out over an area of about 100 square miles in the north-eastern part of the Reserve. The country is almost flat, having a general northerly fall of some 20 feet per mile, and lies across the watershed of the Gwaai and the Manzanymya Rivers, both of which in this area have a north-westerly trend and are typical "sand rivers" of the Kalahari desert, flowing only occasionally during the wet season.

The area is underlain by granite of Archæan age which outcrops to the south and has generally a northerly to north-westerly dipping surface where it passes under the Kalahari

and Karroo sediments. Greenstone-schist, also of Archæan age, occur in places in the granite. They have been encountered in four boreholes, but as they do not outcrop their distribution is largely conjectural. The Karroo beds consist mainly of sandstones below and basalts above, the latter forming the top of the system and occurring, as far as is known, in several flows of varying thickness. The Kalahari formations are also largely sandstones, with some limestones and unconsolidated sands, and over-lie the Karroo unconformably. Pre-Kalahari erosion has in some places completely removed the Karroo basalts, so that the Kalahari formations may be found resting sometimes on the basalts and sometimes on the Karroo sandstones.

Outcrops are infrequent and the soils, as a rule, give little clue to the nature of the underlying formations, so that interpretation of the geology is largely dependent on information obtained from borings. Even with this information it is not possible to distinguish with certainty between Kalahari and Karroo formations unless the basalts are present to mark the top of the latter.

The principal water supplies in the area have been developed by shallow boreholes, and of the twenty-four completed before the date of these tests fourteen had been successful.

Examination of the borehole records allows a grouping of the water-bearing rocks into three categories:—

- (1) Sediments, usually sandstones, directly overlying granite.
- (2) Sandstones underlying the Karroo basalt-flows.
- (3) Sediments, usually sandstones, whose position in relation either to basalt or to granite is unproved in the holes.

Before the date of the resistivity tests there had been one principal cause of failure to obtain supplies. Many of the boreholes placed in the vicinity of the granite outcrop passed from sedimentary formations into granite or into greenstone within 150 feet or less from the surface and were dry, whereas holes with 200 feet or so of sediments were successful. The

necessary conditions for success appeared, then, to involve the presence of a sufficient cover of sediments, but, with no surface evidence to assist in the selection of such sites and with the probability of an irregular bedrock of granite or of greenstone, the reason for a high proportion of failures is clear. It has also been suggested that the elevated situation of the drilling area, lying as it does across the watershed of the district, to some extent accounts for the failure of the Karroo sediments to yield water close to the granite boundary.

The average spacing of boreholes in the reserve is three miles, and, besides increasing the total water supply, each successful hole forms a new centre and relieves the pressure on existing ones. This is of importance in reducing the distances the natives must go to draw water and also in opening new areas for settlement, but probably its greatest importance is in connection with the needs of cattle. With isolated or infrequent boreholes the cattle from many kraals must concentrate on one source of supply, and where the distances from the kraals are large the herdsmen will not trouble to drive their charges far from the water once they have reached it. The result is that the grazing in the vicinity is seriously depleted and is eventually completely trampled out and destroyed for an increasing distance from the borehole. The destruction of the protective vegetation is followed by soil erosion and the transformation of a once-productive area to barren and desert conditions.

Resistivity Method.—The principles and practice of this method have recently been described many times in geological and geophysical literature so that no more than a brief outline is required here.

The object of the method is to take measurements of the electrical resistance of the ground to varying depths and from the values obtained to make an estimation of the probable geological formations present beneath the point of measurement. That such geological interpretations can be made arises from the fact that rocks of different kinds have, in many cases, very different electrical resistivities, so that measurement of these can often give important information about the character of the rock. It will be seen, therefore, that the differentiation of rocks from one another by electrical means

depends essentially on their having different resistivities, and if this condition is not fulfilled the method cannot be of use.

Representation of Results.—Where depth measurements have been made in the way described, by the gradual expansion of the electrode system from a central point, the usual method of using the data is to plot a curve of resistivity against the corresponding separation of the inner electrodes. The shape of this curve then becomes the significant factor in the geological interpretation of the electrical evidence.

The method of interpretation of these resistivity curves, and type examples resulting from certain simple geological conditions, have been considered by several investigators whose results are available in the form of published papers. In all the theoretical and mathematical treatments of the subject, however, many simplifying assumptions have to be made so that, in practice, it is only the simpler cases that allow of an interpretation based on strict mathematical principles. In other cases an empirical solution must be relied on to a greater or to a less extent. Messrs. Gish and Rooney, the original users of the method in the investigation of geological problems, established an empirical rule that is still proving satisfactory, although it has not the support of theoretical investigators. This rule states that in dealing with horizontal formations the passage from a formation of one resistivity to one of another will be indicated by an inflexion on the resistivity curve, and that this inflexion will occur at an electrode separation approximately equal to the depth of the discontinuity. Used with care and due regard for the circumstances this rule is of very considerable value in cases that do not lend themselves to more accurate analysis, or in those where a reasonable margin of error is permissible.

Instruments.—The measurements may be made either with a potentiometer-ammeter apparatus or with an ordinary Megger earth tester. Both were used for the work in Rhodesia. The former apparatus consists of a portable potentiometer reading from 1 to 250 millivolts and a sensitive portable milliammeter. Direct current is employed and in most cases may be supplied from an ordinary 60- or 120-volt high-tension wireless battery. The electrodes for passing the current into the ground may be ordinary steel bars but, in order to avoid

the effect of the large polarization potentials produced by these, special non-polarizing electrodes must be employed for the inner, or potential circuit. The Megger has the advantage over the potentiometer apparatus of giving a reading of resistance directly in ohms and of being more quickly operated; it also employs alternating current supplied from the hand-rotated generator in the instrument itself so that there is no necessity for batteries or to use non-polarizing electrodes for the potential circuit. Its range of measurement, however, is limited, and it is at a disadvantage when the contact resistances of the electrodes are high or when low resistivities at large electrode separations have to be measured. The only other apparatus required is insulated wire for completing the circuit from the instruments to the electrodes, and suitable winding reels for handling the wire.

Both the Megger and the potentiometer apparatus were found to work satisfactorily under the conditions in Rhodesia, and good agreement was obtained between Megger and potentiometer readings of resistivity. In the areas covered by the unconsolidated Kalahari sands ("gusu sands") the contact resistances were always found to be very high, being of the order of 1000 ohms and upwards, and the Megger did not then give reliable results. It was found, however, that where the contact resistances were low, as was usually the case in other areas, the Megger could be relied on for readings as low as 0.05 ohms.

Field Tests at Completed Holes in the Nata Reserve.—It was expected that the resistivity method would be of assistance in enabling an estimate of the depth to bedrock to be made in the areas bordering the granite and also in indicating the depth and thickness of the basalt flows where these occurred. With this object in view the first measurements were made in the vicinity of completed boreholes and characteristic curves were obtained. Further tests were then made at a number of points in order to locate suitable sites at which test drillings could be made.

The general suitability of the method was at once indicated by the differences in the characteristic resistivities of the various formations. Representative values at different electrode separations are given in the table below.

Formation.	Average Resistivity in ohm. cm. at electrode separations of				Remarks.
	50 ft.	100 ft.	150 ft.	200 ft.	
Kalahari and Karoo Sedi- ments	3,750	1,900	1,550	—	In two cases values of 20,000 and 12,000 at 50 ft. and 100 ft. respectively were obtained.
Granite (with Greenstone)	9,000	16,500	—	31,500	
Basalt	5,000 and ranging upwards to 10,000 or 12,000.				

It will be seen that large differences exist between the resistivities of the granite and of the greenstone on the one hand and of the sediments on the other. The figures for the latter decrease with increasing depth of measurement and, although occasional high values were encountered, these were never associated with water-yielding sites; in fact, wherever the sediments were found to give a supply, the average resistivity at the depth at which the water was obtained was always below 3000 ohms. cm. This fact is of considerable importance since it lessens the possibility of being unable to distinguish between the basalt and water-bearing sediments by electrical means: as can be seen from the table there is a chance of the resistivities of the two formations overlapping.

Field Tests at New Sites in the Nata Reserve.—On the completion of the measurements at completed boreholes the work was extended to the testing of new sites. The most urgent problem was the location of favourable points close to the granite contact and in the southern part of the area, where most of the unsuccessful holes were situated.

Conclusions.—The check drilling confirmed the indications from the resistivity measurements in a very satisfactory way and there is no doubt that the preliminary examination of sites by the electrical method would effect a great saving

of time and money. In the areas bordering the granite the thickness of the sedimentary cover may be estimated within twenty-feet or so and the potentialities of the site are indicated by the shape of the resistivity curve and by the minimum values of resistivity. Although no new sites were selected in the basalt areas, there is every reason to suppose that the method can give valuable information regarding the geological conditions.

Analysis of the borehole records shows definitely that the barren results at seven of the sites could have been forecast by preliminary resistivity measurements, while two other holes could have been successfully deepened. The total footage of drilling wasted upon these holes amounted to 1,961, and the time of drilling was roughly a year. The cost of operating the resistivity method is negligible compared with that of drilling and, even bearing in mind that the final test of the method must be the proportion of successes to failures over a period, the potential savings from its use are very large. It is to be hoped that definite figures on this point may eventually become available.

One important point must always be borne in mind. In spite of its successful application to this problem the resistivity method does not locate water directly as such. It is true that the resistivity of a rock is largely determined by the amount and salinity of the water it contains; but, although saturated and of low resistivity, a rock may not yield its water in a well or borehole, or if it does so the water may be unsuitable for use. The success of the method, then, rests upon two things; the determination by electrical measurements of the presence of a formation of suitably low resistivity, and the geological interpretation by which that formation may reasonably be supposed to carry and yield water of suitable quality. The geophysical work must be accompanied and checked by geological observation.

Southern Rhodesia Veterinary Report.

JANUARY, 1935.

AFRICAN COAST FEVER.

Charter District.—Four cases occurred at the Greyling centre and twenty-four at the Riversdale centre. The disease was diagnosed in 16 oxen on Honey Spruit farm and these were all slaughtered. Infection was also found on the farm Doornkasteel, mortality one.

FOOT AND MOUTH DISEASE.

Salisbury District.—Extensions of this disease occurred, all were attributed to contact and all herds involved were inoculated.

Victoria District.—A few extensions occurred in this area.

TRYPANOSOMIASIS.

Three cases in both Hartley and Wankie districts.

TUBERCULIN TEST.

Four bulls were tested on importation, no reaction.

MALLEIN TEST.

Ten horses were tested upon entry with negative results.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Bulls 4, horses 10, sheep 1,662, goats 332, pigs 1.

EXPORTATIONS—STOCK.

To Portuguese East Africa.—Breeding stock 14, oxen 10.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom *via* Union Ports in cold storage.—Frozen boned beef quarters, 636; boned veal quarters, 308; tongues, 2,766 lbs.; livers, 5,500 lbs.; hearts, 9,456 lbs.; tails, 2,818 lbs.; skirts, 1,868 lbs.; shanks, 2,091 lbs.

Meat Products.—From Rhodesian Export & Cold Storage Company: Beef fat, 7,188 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Schedule of Rainfall

FOR WEEK ENDING 2nd APRIL, 1935.

(Final Schedule of Season).

	Total for week.	Total since Oct. 1.	Normal to date.
Bietbridge... ..	Nil	7.67	11.79
Bulawayo	Nil	21.11	22.48
Essexvale	0.12	24.45	24.50
Fort Rixon	Nil	18.20	21.83
Gwanda	0.58	12.68	19.84
Inyati... ..	0.30	25.70	23.81
Matopos	Nil	20.24	22.69
Nyamandhlovu	0.13	20.29	21.21
Bikita... ..	0.53	46.12	37.67
Gutu	0.55	31.43	28.72
Shabani	0.51	17.22	22.33
Fort Victoria	0.04	16.83	24.48
Chipinga	1.64	36.18	39.58
Melsetter	1.54	39.10	—
Enkeldoorn	2.11	32.66	28.35
Gwelo... ..	0.80	30.40	25.20
Hunters Road	0.16	30.27	27.82
Mtao	0.93	25.08	27.85
Que Que... ..	0.18	30.47	27.39
Selukwe	0.13	52.42	38.50
Plumtree	Nil	16.36	22.28
Wankie	0.35	21.16	22.91
Beatrice	1.03	29.71	30.75
Gatooma	1.65	28.48	30.08
Hartley	0.52	33.89	30.42
Headlands... ..	2.17	42.77	25.48
Inyanga	0.87	40.25	36.19
Inyazura	1.22	31.91	35.26

	Total for week.	Total since Oct.	Normal to date.
Macheke	1.90	37.13	32.75
Marandellas	3.05	42.56	34.53
Mrewa	0.79	24.55	33.00
Rusape	1.90	29.64	30.66
Umtali	1.32	28.62	30.10
Arcturus	0.56	46.55	36.60
Bindura	0.29	36.23	30.77
Concession	1.90	56.17	34.83
Glendale	1.65	36.59	33.11
Mazoe	0.28	36.17	32.47
Norton	2.23	26.77	31.51
Salisbury	0.73	35.30	28.77
Shamva	0.52	31.73	31.19
Banket	0.36	34.72	30.07
Miami	1.53	35.56	28.16
Sinoia	0.62	36.66	30.18
Sipolilo... ..	1.57	28.61	31.13
Mtoko	1.52	32.61	27.80
Victoria Falls	0.33	21.12	26.53
Mount Darwin	0.39	33.89	—

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 27. February, 1935.

The Red Locust has been reported in all stages in the Colony during February, namely, eggs, hoppers and adults, and some late egg-laying has occurred. A sample of adult locusts from the Lomagundi district (Miami) included the Tropical Migratory species.

The distribution of Red Locust hoppers has included most of the Colony, but the hatchings in many districts have been very light and have been comparatively or very easily destroyed.

The largest and most persistent outbreaks have been sustained in the low veld and drier districts, including Nyamandhlovu, Wankie, Sebungwe, Lomagundi (Zambesi Valley), Mtoko (low veld), Inyanga (low veld) and Belingwe.

Enemies and Disease.—The main reason for lack of persistence of outbreaks in the higher and more humid parts of the Colony was the heavy mortality produced by *Empusa*. The fungus also affected hoppers in the drier areas, but apparently not to the same extent, and after the sudden failure of the rains about the end of the first week of the month, the disease seems to have been much less in evidence. The remaining hoppers have shown every indication of reaching maturity.

The Black or White-bellied Stork (*Abdimia abdimii*) has been present in the Colony in great numbers and the White Stork (*Ciconia alba*) has been reported from various localities. Parasites, apart from *Stomatorhina* attacking eggs, have not been reported or discovered.

Poisoning of Locust Eating Birds.—Certain experiments have been carried out in collaboration with the Division of Chemistry, to test the danger to birds from eating locust

hoppers sprayed with locust poison. A detailed report will be published later, but it may be stated here that the results obtained indicate that no such danger exists, even if the poison is used at excessive strength.

Outlook.—The outlook as far as the Red Locust is concerned continues apparently favourable, but the failure of the rains will probably admit of more hoppers maturing than would have been the case if the very humid conditions of December and January had continued. The dry weather is also probably favourable to the development of the Brown Locust in Bechuanaland, although the position there is not very clear from available reports.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

FEBRUARY, 1935.

Pressure.—The mean barometric pressure for the month was very considerably above normal, the highest averages occurred in the south, but the pressure was generally over one millibar above the average.

Temperature.—Mean temperatures were universally below normal, varying from about 4° F. below in the south to approximately 2° F. below in the north.

Rainfall.—Rain occurred at all stations in the first decade of the month and some showers were reported about the 20th, but the month on the whole was very much below normal.

The mean rainfall for the month was approximately 3.8 inches, about 1.8 inches below normal, and the total for the season since the 1st October is 25.7 inches, approximately 2.7 inches above normal.

Rainfall in February 1935, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Total	Normal
1	34	22	87	8	22	72	44	...	18	9	1	1	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	321	378
2	35	1	12	79	22	101	4	47	...	63	14	...	...	...	...	...	...	...	...	...	30	46	16	...	...	...	...	3	473	540
3	21	15	5	69	78	50	9	53	...	128	17	...	...	...	...	1	1	...	12	...	69	152	44	22	1	1	4	21	773	794
4	36	3	268	62	50	34	56	1	4	17	3	...	...	...	...	...	...	...	...	...	8	16	4	...	...	...	1	1	564	615
5	42	25	103	14	4	52	43	12	1	27	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	333	508
6	3	23	4	33	195	88	51	34	...	4	1	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	2	446	707
7	10	10	43	29	87	49	69	26	11	56	11	...	...	...	...	...	10	5	1	...	2	27	22	...	...	...	...	3	471	656
8	1	8	2	47	14	16	60	30	...	27	1	...	...	...	...	...	7	29	...	3	16	14	1	...	...	...	...	...	276	705
9	1	29	5	44	4	...	37	18	4	57	2	...	...	...	...	4	...	9	...	...	3	18	4	...	3	...	...	...	242	648
10	2	...	7	18	...	4	57	4	14	38	29	...	...	...	...	...	...	6	...	...	47	...	7	...	...	...	...	...	233	611
Mean	23	17	62	35	45	54	43	19	6	33	7	...	...	...	...	1	1	3	...	...	9	16	6	...	...	...	...	1	381	568

FEBRUARY 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.						Wet Bulb.	Ins.				Nor- mal	No. of Days		
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.										
Angus Ranch...	...	...	87	56	81.0	63.9	72.4	76.4	72.6	67.7	77	63	...	3.44	4.05	9	...
Beit Bridge...	964.7	...	98	58	86.8	67.4	77.2	...	73.5	65.7	67	63	5.9	0.33	1.65	6	1,500		
Bindura...	890.2	...	85	56	79.0	62.2	70.6	...	68.2	63.1	75	60	5.7	2.67	7.51	12	3,700		
Bulawayo...	868.6	867.2	85	46	76.4	56.3	66.4	70.3	68.0	59.6	73	56	4.5	4.09	3.99	9	4,426		
Chipinga...	892.1	...	81	53	73.3	59.0	66.1	...	63.6	62.1	83	60	6.7	7.50	7.40	18	3,685		
Enkeldoorn...	857.5	...	83	50	74.9	55.9	65.4	69.7	63.4	59.5	80	57	5.6	3.53	6.15	8	4,788		
Fort Victoria...	895.6	894.0	87	49	77.1	59.6	68.4	71.5	66.9	61.9	76	59	4.5	2.68	4.75	10	3,571		
Gwaai Siding...	904.9	...	93	49	85.7	59.1	72.4	...	69.1	63.0	72	60	2.5	2.77	4.02	7	3,278		
Gwanda...	906.5	...	90	52	79.9	60.7	70.3	...	68.5	62.5	73	59	5.0	1.55	3.69	13	3,229		
Gwelo...	862.2	...	85	44	76.1	56.4	66.3	70.9	64.8	59.8	76	56	4.9	4.53	5.33	11	4,629		
Hartley...	885.0	...	86	51	80.0	58.5	69.2	72.3	67.6	62.4	74	60	4.8	5.00	7.27	9	3,879		
Inyanga...	835.8	...	77	45	71.5	54.6	63.0	...	62.8	57.9	74	54	4.1	2.55	8.67	9	5,514		
Marandellas...	837.2	...	80	47	71.5	55.0	63.2	...	62.8	57.8	75	54	6.2	6.38	7.19	12	5,453		
Miami...	878.4	...	83	56	77.5	61.0	69.3	...	66.9	63.4	82	64	7.4	3.94	4.95	14	4,090		
Mount Darwin...	906.9	...	86	56	80.2	63.0	71.6	...	70.2	65.4	77	63	7.0	3.54	6.61	11	3,179		
Mount Nuza...	...	...	70	42	61.4	49.2	55.3	...	54.7	53.2	91	53	7.9	7.81	...	21	6,668
Mtoko...	876.8	...	88	53	79.9	60.8	70.3	...	68.0	62.9	76	59	5.1	1.12	5.62	6	4,141		
New Year's Gift...	...	...	89	54	80.1	61.1	70.6	...	69.1	63.6	74	60	...	2.62	5.03	14	2,690
Nuanetsi...	962.3	...	94	52	84.3	62.4	73.4	...	71.9	66.1	75	64	6.7	0.52	3.04	6	1,581		
Pumtree...	864.4	...	85	50	78.3	57.5	67.9	...	66.6	59.7	68	55	3.7	4.02	4.43	6	4,549		
Que Que...	881.7	...	88	48	79.9	57.5	68.7	...	67.1	61.3	72	57	5.1	6.62	6.72	7	3,999		
Rusape...	861.7	...	82	49	73.7	56.8	65.3	...	62.5	59.3	83	57	5.4	6.12	5.28	11	4,648		
Salisbury...	854.3	853.4	84	50	77.4	56.8	67.1	69.4	66.2	60.6	73	57	6.9	4.26	6.54	10	4,885		
Shabani...	907.8	...	90	53	79.4	61.9	70.6	...	68.5	63.3	75	61	7.0	3.50	4.00	10	3,193		
Sinoia...	887.9	...	88	54	82.6	60.9	71.3	...	69.4	63.7	73	61	5.1	1.75	6.82	6	3,795		
Spillo...	884.5	...	84	53	77.6	60.7	69.1	...	68.1	63.0	75	60	5.7	2.25	6.97	12	3,876		
Stapleford...	841.5	...	78	42	69.3	52.5	60.9	...	59.8	57.6	88	57	7.5	7.68	16.91	18	5,304		
Umtali...	892.4	891.5	86	51	78.1	59.9	69.0	71.5	66.6	63.2	83	61	6.9	4.04	6.08	18	3,672		
Victoria Falls...	...	...	94	57	88.0	64.0	76.0	...	69.3	64.3	76	61	3.6	3.56	6.09	6	2,990
Wankie...	926.5	...	94	59	88.3	67.1	77.7	...	74.1	68.2	75	65	3.8	2.57	4.73	9	2,567		

Farming Calendar.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands;

irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of $1\frac{1}{2}$ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 part. of water, or resin wash gives partial

control. The spray must hit the insect to kill. Do no re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "*Trichosoma contortum*," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

MAY.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions

from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

THE RHODESIA Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant.
Department of Agriculture, Salisbury.

VOL. XXXII.]

MAY, 1935.

[No. 5.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Committee to Investigate New Markets.—One of the most urgent needs of this Colony at present is the development of new markets for our agricultural products, particularly tobacco, livestock products, maize, ground nuts, etc. Without the essential expansion of such trade with overseas countries there is no prospect of development for the Agricultural Industry. With the restrictions of our former markets in the South by the new Trade Agreement, or with Great Britain under the quota system now in force, it is absolutely essential that new markets should be developed. To meet these requirements the Government has appointed a committee consisting of the Director of Trade and Industry, the Government

Statistician and the Secretary for Agriculture and Lands (Chairman). A preliminary meeting has been held and immediate steps are being taken to investigate the possibilities for new markets in all parts of the world.

Any person having concrete suggestions to make in this connection which can be supported by information regarding new markets available is invited to place such suggestions and information in writing before the Committee, or alternatively, to request a personal meeting with the Committee.

All communications on this subject should be addressed to the Secretary, Department of Agriculture and Lands, Salisbury, the envelope being endorsed "New Markets."

Tobacco Research Staff.—Acting on the advice of the Tobacco Research Board the Government has appointed two plant breeders to the staff of the Tobacco Research Station at Trelawney, Mr. H. C. Thorpe, B.Sc., and Dr. A. A. Moffett. It is anticipated that Mr. Thorpe will not arrive in the Colony until September, as it has been arranged for him to assist with a series of experiments in plant nutrition now being carried out by the Imperial College of Science and Technology at Rothamstead, as a part of a "refresher" course in plant physiology. Mr. Moffett is paying a short visit to the tobacco research station in the south of Russia before coming out to take up his duties here. This experience will undoubtedly be of the greatest value to him, as a number of most important investigations are being conducted there at the present time.

Fire-cured Tobacco Growers' Association.—At a well attended meeting of growers of fire-cured tobacco held at Shamva last month, it was unanimously agreed to form an Association to look after the interests of that section of the tobacco industry. It was agreed that all growers of fire-cured tobacco should be eligible for membership, but that the acreage which a grower had planted should bear some relation to his voting strength, and that a member should have one vote up to 25 acres, and an additional vote for every additional 25 acres or portion of 25 acres planted.

The following were appointed to the executive committee: Capt. J. M. Moubray (chairman) and Messrs. Jenkins, Butler and Stevenson.

It was agreed that the executive committee should represent the growers in all matters affecting the industry, and should report to the growers at general meetings to be held at least half-yearly.

As it is desired to make the Association fully representative of the fire-cured industry, all growers who are willing to join should communicate with the honorary secretary, Mr. M. L. Stevenson, P.O. Shamva.

Silver, an Effective Bactericide.—A new and interesting commercial application of metallic silver in sterilising water has been brought much to the fore. Silver and some other metals when their surface is exposed to clear water, show the "oligodynamic effect," that is a small quantity passes into solution. In the process as practised the passage of silver-ions into solution is facilitated by passing the water between thin flat silver electrodes through which a low current is passed, the direction of which is reversed every few minutes. After the treatment, the water is allowed to stand for a short period and then becomes sterile. It can be diluted with further water, and continues to act as a steriliser so long as there is sufficient concentration of free silver, which is of the order of one in 20 millions for drinking water. The positive silver-ions no doubt act by combining with the negatively-charged bacteria, or, expressed in organic chemical phraseology, the silver combines with the exposed SH groups of the proteins in the bacteria and disrupt these proteins. The applications of silver in this way, both for sterilising drinking water, large swimming baths, and other fluids, are already considerable, and its use has certain obvious advantages. The quantity of silver which might be taken into the body from the water so sterilised is of no importance compared with the quantity which is ordinarily consumed in the shape of rubbings from spoons and forks. The water has to be clear before treatment, since, if it is turbid, the particles act as nuclei to absorb the silver-ions.

Apparently the sterilising action of silver can be applied widely throughout the food industries and extended to wines and to vinegar, which when sterilised, are said to run no danger of being reinfected. These low concentrations seem also to have a catalytic effect in ageing and stabilising certain liquids and extracts. It would seem that there is a new chemistry awaiting silver, and it may happily play the proverbial part of a silver lining to water in both its liquid and cloud state.—(*Chemistry and Industry*, 30th November 1934, Editorial, p. 1011.)

Quality of Wheat.—The quality of wheat as influenced by environment is subject to a recent paper by F. T. Shutt and S. N. Hamilton (*Emp. J. of Exp. Agric.*, 2, p. 119). The question is not one of scientific interest only, but also of the first commercial importance in the flour-milling and baking industries. Value in wheat depends chiefly on the character and amount of the protein (gluten) it contains, but whereas the former is essentially an inherited factor, the latter may be considerably influenced by environmental conditions. The time which elapses between the formation and ripening of the kernel practically controls its gluten content—the shorter the period the higher the percentage—so that seasonal conditions such as high temperatures and absence of excessive moisture during the later stages of development, which tend to hasten riping, result in valuable high-protein wheat. Conversely, a starchy grain is produced if climatic conditions tend to prolong growth during this period. The richness of the soil, even as regards its nitrogen content, does not appear to have much influence on the quantity of protein in the grain, but its moisture absorbing capacity may be of considerable importance as it is necessarily closely associated with the rate of ripening of the crop. From data which have been collected over a period of twenty-eight years at a number of stations in Canada, it has been deduced that the excellent quality of the wheats from the prairie provinces is largely to be attributed to the favourable seasonal conditions that obtain, and not solely to the selection of the most suitable varieties for that district.

Mycorrhiza in Relation to Forestry.—There is general agreement that healthy growth of pine and other conifer seedlings is always accompanied by free development of fungus-roots, and that poor growth and lack of vigour are associated with defective mycorrhiza formation. No satisfactory evidence has hitherto been offered that the two phenomena are casually related, but M. C. Rayner (*Forestry*, 8, No. 2, 1934) now describes field experiments and laboratory cultures with various species of Pines which prove that the presence of mycorrhizas normal for the species is casually related with proper nutrition and healthy growth of the seedlings. In cases where mycorrhiza development was defective, the condition was relieved and the growth of the seedlings stimulated by inoculating seed-beds with small amounts of humus containing active mycorrhizas of the species. But the beneficial effects following inoculation are controlled by factors operating within narrow limits, since they are really influenced by variation in experimental treatment, as, for example, the date of sowing. Hence it is important that a suitable technique for promoting mycorrhiza formation by means of humus treatments should be carefully worked out and standardised. Evidence was obtained of close correlation between particular soil conditions and the behaviour of specific mycorrhiza-formers; disturbances leading to replacement of mycorrhizas by parasitic pseudo-mycorrhizas with consequences adverse to the health and vigour of the hosts. On the heath soils used in the experiments, it was found that mycorrhiza deficiency was due to inhibiting soil conditions rather than absence of appropriate mycorrhiza-formers, and the inhibiting action was reversed by the addition of organic composts to the seed-beds, resulting in mycorrhiza development, accompanied by increases in root and shoot growth which could not be attributed to direct manurial action.

DEPARTMENT OF AGRICULTURE AND LANDS.

Notice to Turkish Tobacco Growers.

Notice is hereby given that any producer intending to export Turkish tobacco to the Union of South Africa before the expiration of the Quota Year ending 30th June, 1935, is requested to make early application for the necessary Duty Free Turkish Tobacco Export Permit.

In order that the balance of the quota available for export to the Union may be suitably allocated it is required that such application for Export Permits shall indicate:—

- (a) The quantity of Turkish tobacco for which a Duty Free Turkish Tobacco Permit is applied for.
- (b) The quantity of Turkish tobacco already exported by the applicant during the period 1st July, 1934, to the 30th April, 1935.
- (c) The total weight of Turkish tobacco produced by the applicant during the 1934-35 season.

Any application failing to indicate the above returns or which reaches the undersigned later than the 18th May, 1935, cannot receive consideration.

(Signed) H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

27th April, 1935.

A Scraper for Levelling Land.

By D. E. A. GUTSCHE, Field Husbandry Officer, Kakamas.
Kakamas.

The scraper illustrated in Figure 1 is used on the Orange River irrigation lands for the purpose of levelling lands, piling up dam walls or training banks, and performing other similar jobs. Although many other types of scraper have been imported and tested, this simple home-made device has been found to be the most effective as well as the cheapest variety, and to do very good work.

The local price of the materials required is between 15s. and 20s.; the scraper is delivered by local blacksmiths for 30s., which includes all materials, excepting the trek chain.

The most popular length is 6 ft., although 8 ft. scrapers are also found. The 6 ft. scraper is drawn by a span of 6 or 8 mules.

The implement consists of two 6-ft. deal boards (A), $1\frac{1}{2}$ in. thick and 9 in. broad, held together by steel strips at G, C, F, D, and E. (Fig. 1). These strips may be made of old 2- or 3-inch wagon tyre, preferably 3-inch, especially in the case of the strips at C and D, to which the trek chain is attached. At the same time these strips serve to hold the sharpened share (B), which is also made of old wagon tyre 3 or 4 inches in width.

To strengthen the scraper it is necessary to have strips of tyre at the back, corresponding with those in front, as shown in the cross-sectional drawings. All these strips are bolted to the woodwork, but rivetted to the share. The front strips C and D are bent as shown in Fig. 2, to provide points at which the trek chain may be attached. It is most important that the middle of this bend should be exactly 6 inches from the lower edge of the share, otherwise the scraper will be difficult to control. Each half of the trek chain must be at least $4\frac{1}{2}$ ft. long.

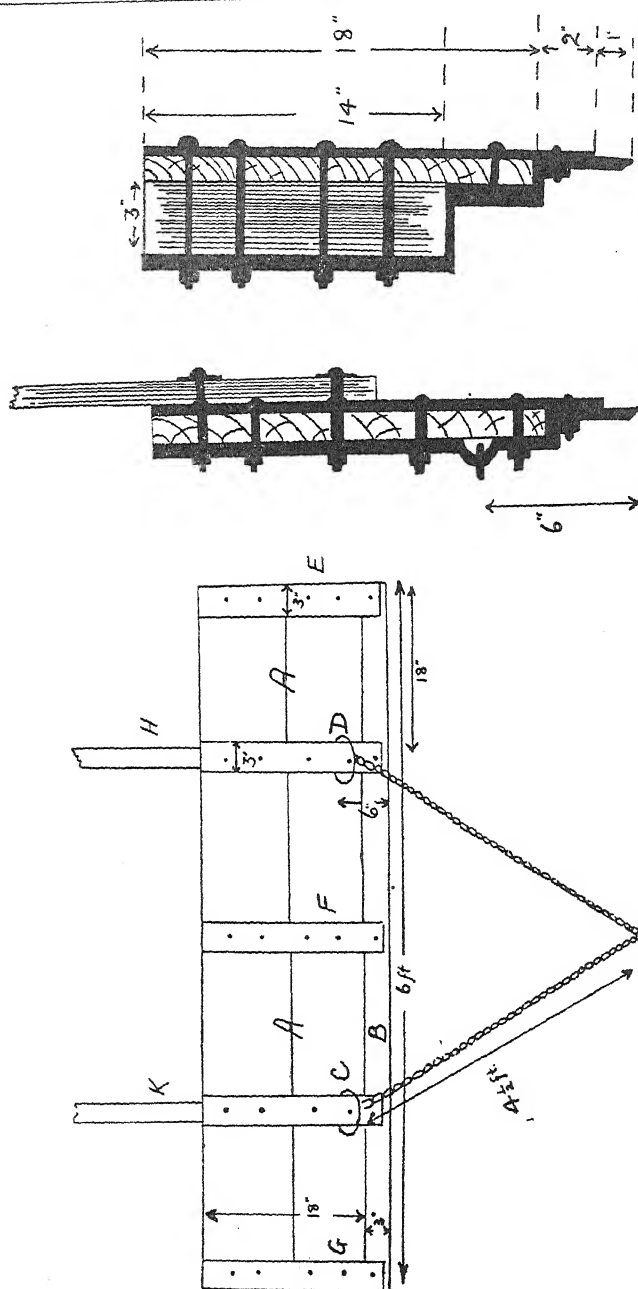


Fig. 2.—Cross-section at C and D.

Fig. 1.—Top view of scraper.

Fig. 3.—Cross-section at G and E.

The implement is controlled by means of the handles H and K, which are made from any round-shaped wooden poles of 2 or 3 inch diameter, and project about 3 ft. above the scraper, to the back of which they are attached by means of two of the bolts passing through the steel strips. (Fig. 2).

At the ends of the scraper (E and G), pieces of deal 3 in. by 3 in. by 14 in. are fixed underneath the front strips of steel, which have been previously bent accordingly, as indicated in Fig. 3. These blocks serve to prevent the soil from escaping, and also to protect the woodwork when the scraper is being drawn empty over the ground.

How the Scraper Works.—The implement is used as follows: To fill it, it is drawn almost flat along the ground so that the share cuts into the ground. Directly it begins gathering up soil, the handles are slowly lifted up until they make an angle of 60° with the ground. In this position the scraper will take up no further soil, and the soil in it may then be dragged to the places where it is required.

The great advantage of this scraper lies in the fact that all the soil it carries may be emptied at one spot or spread over any distance from 5 to 20 yards. If all the soil is to be deposited together, the handles are simply pushed over rapidly towards the animals drawing the scraper, and in this position the empty scraper is drawn back to the high ground. If the soil is to be discarded gradually over a longer distance, the handles are first held upright, and as the soil slips through under the share, they are gradually brought over forward, and when the scraper is empty, thrown right over. Many farmers tie a riem to the top of one of the handles, to facilitate controlling the scraper while discarding soil after it has passed an upright position. This riem will also be found useful for tilting the scraper back again when it is to be re-loaded.

Ground on which this scraper is being used should be loosened to a depth of a few inches. This may be done with a light plough or a spring-toothed harrow.

On very stony ground the scraper functions with some difficulty, as the share is inclined to jump over the stones, causing the soil to slip through underneath.

The writer will be glad to furnish any further information desired —(*Farming in South Africa*, March, 1935.)

Report of the Poultry Branch

FOR THE YEAR ENDING 31st DECEMBER, 1934.

By H. G. WHEELDON, Chief Poultry Officer.

General.—It is gratifying to note there has been increased activity among poultry farmers during the year under review. Although this cannot be regarded entirely as new development, it can be taken as a tendency towards the return to normal conditions. The number of poultry producers has increased during the year. As a result of the depression and unsatisfactory marketing conditions some farmers, especially in remote areas, began to lose interest and even neglected their poultry, but observation in Mashonaland indicates a decided expansion of the industry, whilst in Matabeleland the industry can best be described as “steady.”

The ruling price for poultry products during the depression years was low, and last year was lower than in any previous year in the history of the industry. The restrictions in regard to foot and mouth disease resulted also in a shortage of imported foodstuffs with inflated prices. The low prices for eggs and inflated prices for poultry foods affected the returns to producers and resulted in a general reduction in the size of flocks and decreased egg production. There has been recovery in this respect this year. Egg prices improved, the cost of foodstuffs became more economical to producers and this was followed by an extensive demand for day-old chicks and other young stock for production purposes with extension in the size of flocks.

It is confidently expected as a result of this improvement next year will see a return to normal production with possibly an exportable surplus in due course.

The established stock breeders had a satisfactory hatching season and the renewed demand for day-old chicks and other stock was distinctly encouraging to them.

Poultry flocks remained healthy during the year, and it is gratifying to note there are no serious losses to report from epidemic diseases.

Markets.—There were no exports to the overseas market during the year, but the export of eggs to fill contracts in the Northern Territory was continued. The local demand and price level for eggs were so encouraging that the surplus stock in storage was retained for the local market. Cold storage stocks amounting to approximately 1,500 cases were absorbed at prices more remunerative than could be expected on the overseas market.

The average price level for eggs in the local markets advanced approximately from 1s. 2d. in 1933 to 1s. 8d. per dozen in 1934. Co-operative producers did not feel the full benefit of this improvement owing to the fact that the supplies to the Company considerably decreased and the overhead costs remained proportionately high.

It is a matter for regret that the general position of the Egg Circle shows no improvement in regard to its membership, and it is sincerely hoped that steps will be taken in the near future to ensure a more satisfactory condition. The majority of the large producers do not co-operate and apparently prefer to rely on their own independent initiative.

The market for other poultry products, such as table fowls, ducks and turkeys, has been consistently good during the year. Prices generally obtainable for table birds are satisfactory, and even culled poultry of the heavy breeds from the laying flock meet with good demand.

The Poultry at the Christmas market, especially turkeys, fetched exceptionally good prices this year. The ruling price for these being approximately 2s. per lb. live weight. The prices for young fowls, ducks and geese proved to be much more satisfactory to producers than last year.

Southern Rhodesia Egg Laying Test.—The Fifteenth Annual Egg Laying Test was commenced as usual on March 1st. Uncertainty in regard to the restrictions due to the foot and mouth disease, and the unsatisfactory state of the egg market last year, resulted in fewer entries than usual. These restric-

tions have a limiting effect on the support we might expect from the Union of South Africa. This test has otherwise proved satisfactory and encouraging records will be obtained.

Poultry Station.—Salisbury.—The work at this Station, including experimental work, was conducted satisfactorily during the year on a moderate scale. It is hoped with improvement in the general outlook of the industry that development at this Station might in due course be considered with a view to carrying out to a greater extent experimental work for the benefit of producers.

Matcpes.—There have been no students at this institution during the year, but the Poultry Officer in charge has conducted useful experimental work in addition to his extension services in Matabeleland.

Shows.—Poultry shows were held as usual in the principal centres of the Colony. The number of entries generally was slightly less than in the previous years. The quality of the stock and preparation of the birds for showing was much improved.

Extension Services.—As far as possible regular visits have been paid to poultry farmers in various parts of the country.

Correspondence and contributions to the *Agricultural Journal* and other publications have been maintained. The request from Farmers' Associations for lectures and demonstrations have been complied with by poultry officers.

The use of Salt in Haymaking.

By W. O. SCHULTZ, Agronomist, School of Agriculture,
Cedara, Natal.

The Cedara School of Agriculture has received several inquiries in regard to the "curing" properties of salt, and these call for an explanation which should prove of general interest.

It has been suggested that hay can be made from green crops which are stacked immediately after cutting, provided that ordinary salt is added. Actually the result of such a procedure will not be hay, but silage.

Salt has its place in hay-making as an agent for increased palatability and as a preservative, but it can only be added after the plants have cured normally in the field. The practice of adding salt is not a common one in this country, but it has its decided advantages where the hay on the land has been subjected to frequent rains and where the quality in general has suffered. Ordinary coarse salt is used at a rate of approximately 30 lbs. to 1 ton of hay, the salt being sprinkled over layers of approximately 1 foot depth during stacking.

While, therefore, the use of salt does not eliminate the ordinary hay-making operations, it should prove of value where damp and rainy weather is experienced.

Experiments on the Toxicity to Fowls

OF ARSENITE OF SODA AND POISONED LOCUSTS.

By J. K. CHORLEY, F.R.E.S., and R. McCHLERY, B.A., B.Sc.

In view of the repeated allegations that the natural enemies of the locust, in particular the European White Stork, *Ciconia alba*, are being poisoned in large numbers by the use of arsenite of soda as a locust poison, a series of experiments was recently carried out by the Divisions of Entomology and Chemistry at Salisbury, in order to determine

- (1) The lethal dose of arsenic in the form of locust powder (arsenite of soda, 80%, As_2O_3) for poultry, and
- (2) The effect of feeding poisoned locusts to poultry.

Experiment I.: Object: To ascertain the lethal dose of locust poison to poultry.

Method.—The lethal dose was ascertained by feeding pills of pollard containing varying quantities of locust poison to four healthy cocks. The doses were calculated in terms of arsenious oxide (As_2O_3).

Description of Bird.	Weight.	Dose administered.	Remarks.
1. Black Australorp	6 lbs. 13 ozs.	1½ grains (0.10 gms.)	Died in 4 hours.
2. Rhode Island Red... ..	5 lbs. 10 ozs.	1 grain (0.0667 gms.)	*Died in 12-20 hours
3. Rhode Island Red... ..	6 lbs. 9 ozs.	¾ grain (0.050 gms.)	*Died in 12-20 hours
4. Rhode Island Red... ..	5 lbs. 5 ozs.	½ grain (0.0333 gms.)	Alive and healthy.

*Death occurred during the night.

The clinical symptoms exhibited during the course of the experiment were as follows:—

Bird No. 1.—Drooping within half-an-hour; the bird lay down within an hour and failed to rise again. No diarrhœa. Death occurred in 4 hours.

Birds Nos. 2 and 3.—Drooping, lassitude, heavy greenish diarrhœa, ruffling of feathers and limp comb. Eyes remained bright. Bird No. 2 expelled a large tape-worm before death. Both birds died in 12-20 hours.

Bird No. 4.—No visible signs of sickness. Eye and comb normal. No diarrhœa, but fæces loose. Fed normally.

The *postmortem* findings on the three dead birds were not typical of arsenical poisoning, the principal features observed being catarrh of the gizzard and intestines and slight enteritis.

On analysis the principal organs showed the following amounts of arsenic present:—

Dose As_2O_3 .	No. 1. 0.10 gms. gms. As_2O_3 .	No. 2. 0.0667 gms. gms. As_2O_3 .	No. 3. 0.050 gms. gms. As_2O_3 .
Crop and contents	0.0332	0.0148	0.0040
Gizzard contents	0.0284	0.0159	0.0167
*Gizzard	0.0001	0.0002	0.0002
*Intestines	0.0001	0.0001	0.0020
*Kidneys	0.0003	0.0010	0.0001
Total recovered	0.0621	0.0320	0.0230

*Estimated by comparison with standard mirrors.

It will be seen that the amount of arsenic found in the intestines of bird No. 3 is much greater than in the others. This is most probably due to the large quantity of intestinal fluid in this sample; the fluid in the other samples was almost entirely lost.

Result.—The lethal dose for a bird weighing between 5 and 7 lbs. was ascertained to be between 0.5 and 0.75 of a grain of arsenious oxide (As_2O_3).

Experiment 2: Object: To ascertain the effect of feeding poisoned locusts to poultry.

A supply of poisoned second-stage Redwinged locust (*Nomadacris septemfasciata*) hoppers was obtained. These had been carefully sprayed under field conditions with three different strengths of locust poison (asenite of soda, 80% As_2O_3), *viz.*, normal strength, or $3\frac{1}{2}$ ozs. to 4 gallons of water, twice normal strength, and three times normal. On analysis, after thorough air-drying, representative samples gave the following results:—

	Normal spraying.	2 x normal.	3 x normal.
As_2O_3 %	0.019	0.028	0.058
Grains As_2O_3 per ounce ...	0.081	0.12	0.25

Some rain, probably about $\frac{1}{4}$ inch, fell on these locusts after they had been sprayed and before they were collected, and consequently a further supply of fourth-stage hoppers sprayed at normal strength was obtained. On analysis these gave the following results:—

Loss of moisture on drying	66.4%
Arsenious oxide on air-dried sample ...	0.0091%

This is equivalent to 0.040 grains As_2O_3 per ounce of air-dried locusts or 0.013 grains As_2O_3 per ounce calculated on weight before drying. The amount of arsenic present on these locusts was approximately one-half of the amount present on the first supply of normally sprayed locusts. The difference cannot be accounted for except on the basis of difference in the stage of development of the hoppers used.

The experiment was carried out on a Rhode Island Red cock weighing 6 lbs. The bird refused to eat air-dried sprayed locusts alone, but on their being ground and a moist mash made with equal portions by weight of pollard, it ate the mixture readily. The bird was supplied each day with more food than it could consume. To begin with, it was given, over a period of $5\frac{1}{2}$ days, a total of $21\frac{1}{2}$ ozs. of mash made from normally sprayed hoppers containing 0.08 grains As_2O_3 per ounce. Over a further period of $12\frac{1}{2}$ days it was given a total of 60 ozs. of mash made from heavily sprayed locusts containing 0.25 grains As_2O_3 per ounce. The total amount of

arsenic consumed during the 18 days of the experiment, expressed as arsenious oxide, As_2O_3 , was 8.37 grains or 0.465 grains per diem. Over the final period of $12\frac{1}{2}$ days the bird consumed 7.5 grains of As_2O_3 or 0.6 grains per diem. The daily ration was approximately the lethal dose as ascertained by the first series of experiments.

Within about 10 days of commencing the experiment a marked improvement in the condition of the bird was noticed, its plumage becoming more glossy, its eye brighter and comb redder and more erect. Its faeces were loose, but it continued to feed well. During the experiment it gained 4 ozs. in weight and at no time were symptoms of arsenical poisoning observed. One free range after the experiment the bird maintained perfect health and gained $1\frac{1}{2}$ lbs. in weight in less than two months.

Some idea of the elimination of arsenic from the system was obtained from analysis of the faeces. The total faeces excreted from 10 a.m. on the 22nd February to 10 a.m. on the 25th were collected and the arsenic determined in representative portions. The following results were obtained on analysis:—

Total faeces collected	476 gms.
Arsenious oxide found	0.1346 gms., or 2.07 grains.

This period covered a portion of the period during which heavily sprayed hoppers containing 0.25 grains As_2O_3 per ounce were being fed. The total amount excreted per day was 0.69 grains, slightly more than was actually being supplied to the bird at the time. This was probably due to accumulated arsenic being slowly excreted from the body.

Summary.—1. The lethal dose of arsenic expressed as arsenious oxide (As_2O_3) was found to be between 0.5 and 0.75 grains for a bird weighing between 5 and 7 lbs.

2. A Rhode Island Red cock refused to eat air-dried locust hoppers, but when given a moist mash containing 50% by weight of poisoned hoppers it ate readily.

3. The total amount of arsenic expressed as arsenious oxide consumed over a period of 18 days was 8.37 grains.

4. During $12\frac{1}{2}$ days the bird consumed 7.5 grains of arsenious oxide or 0.6 grains per day without any ill effects.

5. Over a short period the amount of arsenic excreted in its faeces was slightly greater than the amount of arsenic being consumed in that period.

6. The bird improved in appearance and gained 4 ozs. in weight during the period of the experiment.

Conclusions.—(1) It would appear that when arsenic is administered in small quantities, such as in sprayed locusts, a domestic fowl can tolerate comparatively large doses over a long period without any visible ill effects.

(2) Locusts sprayed at normal strength can be fed to poultry without any danger, as it would appear to be impossible for them to consume sufficient locusts in one day to obtain a lethal dose of arsenic.

Annual Report of the Tobacco Branch

FOR THE YEAR ENDED 31st DECEMBER, 1934.

By D. D. BROWN, Chief Tobacco Officer.

Seasonal Conditions.—The season opened rather early and rains were fairly generally distributed. Tobacco seed-beds made rapid growth and were comparatively free from disease and insect pests. Owing to the incidence of good planting rains a considerable acreage was planted by an earlier date than is usually the case. By the end of November a large proportion of the crop had been transplanted under very favourable conditions. In a few small areas, however, a shortage of rain was experienced and, consequently, transplanting operations were delayed. A dry spell of three weeks' duration occurred towards the end of December which in some cases checked the growth of the tobacco and prevented further transplanting operations. Heavy rains recommenced about mid-January and the incidence of disease tended to become rather more significant. Insect pests were responsible for a limited amount of damage as compared with the previous season. Generally, the crop made excellent progress and was comparatively free from disease.

Staff.—With only one officer available for advisory duties, it has been found impossible to meet adequately the demand arising in connection with this work. Thus is repeated a state of affairs as they existed during the previous year. There is pressing need for putting into effect a policy enabling the technical training of suitable Rhodesian youths who could, when properly qualified in tobacco culture, be drafted to the staff of this Branch. The industry continues to expand and

the staff of advisory officers requires to be commensurately increased in order that requirements in connection with the development and welfare of the industry be reasonably provided for.

Tobacco Research.—Several changes of staff took place during the year under review. The Foreman, Tobacco Research Station, Salisbury, was transferred to take up similar duties on the Tobacco Research Station at Trelawney. The vacancy on the former station was filled by a temporary appointment. The Tobacco Research Officer was transferred from the Salisbury station to headquarters and acted for the Chief Tobacco Officer during the latter's absence on leave. The Plant Breeder then had charge of the Tobacco Research Station at Salisbury.

The work preparatory to the programme of research to be conducted on the Tobacco Research Station, Trelawney, during the current season, was in large measure accomplished by Foreman Capeling, to whom credit is due for the satisfactory progress of this work. On the Tobacco Research Station, Salisbury, the following experiments were continued for the third consecutive year:—

- Potassic Fertiliser Trials.
- Phosphatic Fertiliser Trials.
- Nitrogenous Fertiliser Trials.
- Date of Planting.
- Spacing Trials.
- Topping Trials.
- Priming Trials.
- Suckering Trials.

Plant selection and varietal trials were also continued. As the result of plant breeding work, several improved strains have been developed. In co-operation with the Chief Entomologist and the Plant Pathologist, experiments were continued in regards to Nematode Control and Disease Control.

A change in the policy relative to tobacco research was made during the year and since August the Tobacco Research

Board, comprising two official members and two representatives each of the buyers and the growers, has assumed control of tobacco research. Power to expend funds made available for tobacco research will be vested in the Board through the agency of special legislation. Resulting from the policy now obtaining in regard to tobacco research, a further reorganisation of the Tobacco Branch has been effected whereby all matters pertaining to scientific research have been entirely eliminated from the functions of this branch and transferred to the Senior Plant Pathologist's branch.

This arrangement necessitated also the transference of certain members of the Tobacco Branch to that of the Senior Plant Pathologist, and to these officers due acknowledgement is made of the services loyally given during the period of their association with this branch.

Crop Production: Southern Rhodesia.

Year.	VIRGINIA TYPE.			TURKISH TYPE.		
	No. acres.	Total yield. lbs.	Av. yield per acre. lbs.	No. of acres.	Total yield. lbs.	Av. yield per acre. lbs.
1925... ..	7,550	1,987,382	263	891	418,552	469
1926... ..	13,160	5,313,186	404	755	346,623	459
1927... ..	29,172	18,631,069	638	992	633,488	638
1928... ..	45,711	24,491,464	536	911	451,580	496
1929... ..	16,761	6,704,936	400	1,023	337,478	330
1930... ..	9,681	5,494,063	568	787	350,140	445
1931... ..	15,317	3,268,926	540	828	375,464	453
1932... ..	24,077	14,448,440	600	1,277	577,726	452
1933... ..	33,411	13,777,286	412	971	393,356	405
1934... ..	41,378	26,097,888	630	1,423	694,204	487

NOTE.—The figures for the year 1934 are as stated in the Final Returns submitted by the Government Statistician.

Production Average.	VIRGINIA TYPE.			TURKISH TYPE.		
	Acres.	Yield lbs.	Acre yield.	Acres.	Yield lbs.	Acre yield.
1925-29	22,470	11,425,607	448	914	437,544	578
1930-34	24,772	12,617,320	550	1,057	478,178	448

Total Production (all Types).

Year.	Quantity.
1930	5,844,203 lbs.
1931	3,644,390 ,,
1932	15,026,166 ,,
1933	14,170,642 ,,
1934	26,792,092 ,,

Export Unmanufactured Tobacco.

Destination.	1930. lbs.	1931. lbs.	1932. lbs.	1933. lbs.	1934. lbs.
United Kingdom	4,516,827	5,223,504	10,207,222	9,917,654	16,392,313
Union of S.A. ...	2,020,378	2,306,721	2,354,121	2,106,653	2,492,048
P.E. Africa	170,500	250,127	82,127	55,735	50,048
Other countries	106,430	40,140	638,205	74,750	2,251,249
Total export ...	6,814,135	7,821,296	13,281,675	12,154,742	21,185,658

Consumption of Southern Rhodesia Tobacco in the United Kingdom.

Year.	Quantity.
1926	1,098,000 lbs.
1927	2,000,000 ,,
1928	4,095,000 ,,
1929	5,067,000 ,,
1930	5,322,000 ,,
1931	6,262,000 ,,
1932	7,871,000 ,,
1933	8,610,000 ,,
1934	9,279,664 ,,

It will be noted that the total acreage planted this year is the second largest recorded during the past decade, whilst the average yield per acre also is the second highest in the case of the Virginia type and third highest in the case of the Turkish type. The production of either type and the total quantity produced represents the largest crop of tobacco yet

raised in this Colony. The exports during the year under review exceeded the previous record established in the year 1927 by five and a half million lbs.

The steady increase in the consumption of Southern Rhodesia tobacco in the United Kingdom has been maintained this year. In this connection it may be stated that fairly heavy stocks of Southern Rhodesia tobacco remain in bonded warehouses. Growers would, therefore, be well advised to study their production and keep within reasonable limits of market requirements, otherwise the unsatisfactory state of affairs as they existed during the period 1928-1931 are likely to be repeated. To ensure a greater measure of stability to the industry, new markets must also be developed.

In conclusion, it is desired to express appreciation of the ready assistance given by other branches of the Department.

Protect Cream from the Sun.

The following note is taken from the February number of the *Tasmanian Journal of Agriculture*. The warning given to Tasmanian farmers is of special significance to this Colony, which is situated from 25 to 30 degrees nearer the Equator.

“Cream grading at factories by dairy officers has shown that in far too many cases cream which would otherwise have been graded choicest has had to be placed in an inferior grade through being exposed to the rays of the sun whilst waiting to be picked up by the factory lorry, and has indicated the necessity of cream stands being erected by all suppliers who leave their cream at the roadside to be picked up by the carter.

“Dairymen should be sufficiently alive to their own interests to erect some protection for their cream from the direct rays of the sun whilst it is awaiting transport, particularly at times such as these when prices for butterfat are at such a low level. This does not appear to be the case, for a journey along many country roads will show that in many instances cream cans are stood at the roadside quite unprotected. During periods of high prices, a half-penny or even a penny per lb. from their cream cheque may not have appeared serious to many dairy farmers, but with the values ruling at present no farmer can afford to run any risk of deterioration of his product which will entail his receiving less than the highest possible price, particularly when the trouble may be obviated practically without cost. The Dairy Product Act provides that all dairy produce must be protected from the direct rays of the sun, and makes it an offence for any person to sell dairy produce which has been, to the seller's knowledge, exposed to the sun's rays. The Department up to date has not insisted on strict compliance with this section, but the position is becoming so serious that definite action will have to be taken against suppliers who are not complying with the requirements.

"Any deterioration in quality of cream is primarily a loss to the individual supplier, but it also reflects on the prosperity of other suppliers and on the State as a whole. There can be no doubt but that the large percentage of inferior butter contained in our export pack has a very definite bearing on the price which we receive for our choicest butter, and any factor which may influence ruling market rates for our butter is definitely the concern of the State.

"A cream stand is not an expensive item and can usually be constructed from materials available on the farm, and the only expense will be the small amount of labour involved. No definite type or size of stand is prescribed, and it is left solely to the supplier himself to determine how simple or how elaborate a stand he constructs. The stand should be sufficiently high to raise the cream can two feet or more above ground level, and it should be so constructed that the sun cannot shine directly on to the cream can. The type of stand recommended is one which has a floor at least two feet above ground level, the floor being constructed of narrow slats with a gap between each slat. The back and sides should be louvred to permit free circulation of air, which will tend to keep the cream cool. The top should be watertight and should have a sufficient slope to turn off all rain."

FEEDING THE DOG.

By W. E. CHAMBERLAIN, Veterinary Pathologist,
Tasmanian Department of Agriculture.

Much diversity of opinion exists in the matter of feeding dogs. It would appear that this is due largely to a lack of knowledge of canine anatomy and to a false impression that foodstuffs suitable for man are readily assimilated by the dog. Experts of eight countries attending the Canine International Congress held under the auspices of the Canine Society of Monaco in March, 1934, agreed that the dog, being essentially a carnivorous animal, should have raw meat as a basis for its diet.

Dogs, like other domesticated animals, evolved from a foundation stock which roamed the country seeking its own food. Over many thousands of years these ancestral dogs developed constitutions in conformity with their natural habitat and methods of feeding. Immediately domestication took place the dog was deprived of this privilege of fighting for, and selecting, his food; he was compelled to lead a more or less sedentary life, and at the same time accept such morsels as his owner thought fit to give him. How often are these morsels mere scraps, and how often are they fed without any intimate knowledge of the actual requirements of the dog!

Dog fanciers would benefit by paying some attention to the natural digestive system of the dog. The teeth constitute the first point of importance. These in the dog have developed into structures eminently suited for the tearing of flesh and the crushing of bones. Whereas the horse and cow have incisors for pulling herbage, and molars for grinding and masticating, the dog has well-developed cutters, fangs and crushers.

The saliva of a dog has a certain peculiarity. In the saliva of man and many animals a property (an enzyme) is present which enables the digestion of sugary substances to commence in the mouth. In the dog, this substance, if present at all in the saliva, exists in very minute quantities only. In fact, whereas digestion starts in the mouth of man and most of the domesticated animals, in the dog, owing to the rapidity with which food is swallowed, the digestive process begins in the stomach. The stomach of the dog is relatively large and is not divided into compartments as in the ox and sheep, and the gastric juice, which is secreted in large quantities for the digestion of meat, is unsuited for the digestion of vegetable matter. Ruminants (herbage eaters) have been provided with a stomach composed of four sections, each of which has a part to play in the digestion of plant matter. The intestine of the dog is relatively short and lacks the large compartments (cæcum and colon) which are peculiar to the bowel of herbage eaters. Provision is made for an adequate supply of bile, necessary in the digestion of fat, by the presence of a liver of peculiar size and structure.

Food, whether available in the form of vegetable or animal tissue, contains identical properties necessary for building up and maintaining the body, supplying energy and producing heat. Some forms of animal life have developed constitutions suited for the digestion of food available in vegetable form, others for the digestion of food available in animal form, others again for the digestion of food available in both forms. As plant tissues differ considerably from animal tissues, it is reasonable to expect not only digestive derangements, but constitutional disturbances should an animal be fed on the type of food unsuited for its natural digestive process.

It has already been shown that the dog belongs to the group of animals (carnivora) whose constitutions are eminently suited for the digestion of food in the form of meat. Meat, however, comprises flesh, bones and viscera, each of which has its particular virtues, *e.g.*, energy in muscle, minerals in bones, sugar in liver. The wild dog kills his prey and, if food is abundant, selects those portions of the carcase which are the most palatable. Under natural conditions

palatability is an indication of the actual requirements of the animal. Under conditions of domestication a depraved appetite is frequently merely indicative of a desire to obtain some essential foodstuff which is either absent from the diet or present in insufficient quantities. The domesticated dog is frequently compelled to subsist on scraps without any thought of its actual requirements. In this connection station and farm dogs have the advantage over the average city dog. Unfortunately, this advantage is nullified to some extent owing to the incidence of hydatids in this country. When raw viscera (*e.g.*, liver, heart and lights) containing hydatid cysts is consumed, the bladder of the hydatid cyst disappears in the digestive tract, leaving a minute head which adheres to the wall of the intestine and grows into a tapeworm. It is for this reason that abattoir and station dogs in particular are frequently heavily infested with tapeworms and should therefore be regularly dosed. Also, owing to the danger of infection of human beings and animals with hydatids, internal organs should never be fed raw, but should be well cooked in order to destroy any cysts which may be present.

Meat, other than internal organs, should be fed raw. Experts at the Canine International Congress agreed that the correct diet for a dog was raw, "complete" meat—that is, meat representative of the various parts of the animal body. It was pointed out that raw meat contained the various substances (proteins, vitamins, minerals, etc.) required by the body of the dog, in the form most suited for the dog's digestive system. The experts considered that, owing to the peculiar size and structure of the dog's stomach and to the desirability of meat remaining in the stomach until well digested, raw meat should be fed in lumps and not minced or supplied in powdered form. The authorities agreed that raw meat should be fed to puppies, even before weaning.

The statement that raw meat makes a dog savage is supported by very little evidence. Doubtless, correct diet will develop a dog true to type, but dog fanciers who withhold meat may ultimately find that their dogs have lost their natural virility and are fat and diseased. Again, raw meat does not cause distemper. Although this fallacy still exists,

it has been definitely proved that distemper is due to a very minute germ (virus) and is, in fact, a highly contagious disease.

Cooked meat is regarded as detrimental to growing dogs. It is generally accepted that cooking reduces the value of meat by destroying or inhibiting certain properties such as vitamin content.

Delegates to the Congress discussed the matter of vegetable products in the diet of a dog, and agreed that the digestive system of a dog could not cope adequately with this type of food. Biscuits or cereals might be included in the diet, but if so they should be well cooked and fed dry. As sugary substances inhibit the secretion of gastric juice, they should not be fed immediately before or after a meal of meat. Cow's milk is not recommended and, in fact, may be a retarding influence on the development of a growing dog. Cow's milk, differing in composition from that of dog's milk, may be improved by adding one egg to every two ounces of milk, or by evaporating to one-third of its original volume.

Bones are of necessity part of a complete meat diet. They are particularly rich in lime, phosphorus and other minerals, both in the hard substance and in the marrow. Bones, in addition, have a part to play in the strengthening of the teeth, gums and muscles of the jaw. Sheep's head broths have a considerable nutritive value, and trotter jellies are often prescribed in cases of enteritis and other bowel troubles.

Biscuits (dog biscuits and not sweet biscuits) are useful adjuncts to a diet provided that they are produced by a reputable firm and are fed dry. Sweet biscuits predispose to conditions such as obesity and teeth troubles.

Sunlight, fresh air, and a plentiful supply of clean water are at all times essential.

Puppies require feed for both growth and sustenance. Small amounts of raw meat should be supplied prior to weaning in order that the puppies may be fed a meat diet immediately weaning has taken place. Prepared milk may be included in the ration at first, but should be discontinued after about two months. Broths and gravies are useful, and

cooked liver is a valuable adjunct to the diet. A few drops of cod liver oil may be given daily in the feed if any suspicion of rickets or bone weakness exists. Puppies should be fed three times a day until the fourth month, and subsequently twice daily.

The diet of an adult dog must be computed according to its particular requirements. In general, remembering that digestion in the stomach of the dog is naturally slow, and that some hours elapse before meat is ready to pass onwards into the small intestine, a dog rarely needs more than one good meal daily. This meal may, however, be supplemented by a second smaller feed. In order that the dog may develop regular habits it is advisable to feed at certain definite hours. Feeding should be undertaken by one particular individual.

The amount of food required varies with factors such as size, age, pregnancy and work. A working dog requires considerably more than a yard or lap dog. A medium-sized dog requires little more than half an ounce of food per day per pound body weight as a maintenance ration, a heavy dog slightly less, and a lightweight slightly more. Actually, the amount may vary from approximately $\frac{1}{2}$ lb. for a small terrier to 4 lbs. or more for a Great Dane. As a general rule, working dogs require a full meat ration, whereas those leading a lethargic type of life may receive a small proportion of biscuit.

The hour for feeding depends upon the type of dog. An ordinary household watchdog, to be wide awake at night, should have its main meal at mid-day. Sheep and sporting dogs, being expected to work during the day, should receive their full meal in the evening. Sheep dogs, if hard at work may need some additional feed during the daytime. Never feed a heavy meal just prior to exercise.

Incorrect diet is responsible for many of the common ailments of dogs. Diseases of the skin (*e.g.*, eczema) are repeatedly seen in dogs which have been fed on sweet biscuits, cakes, etc., in large quantities. Pyorrhœa and associated teeth troubles are frequently found in house-fed and pampered dogs, rarely in dogs which live healthy outdoor lives and which are given a plentiful supply of bones.

Constipation is a common sequel to incorrect feeding met with in older dogs. It is often very difficult to treat owing to an apparent inertia of the intestine. Oily foods help to overcome this trouble.

Where inappetence is a characteristic of a disease it may be necessary to coax the patient with any food which may be palatable. Foods such as milk, egg flips, cooked liver, brains, boiled tripe, meat extracts, starchy foods may be tried. Care must be taken that these foods are not given in excessive quantities and hence subsequently vomited. Calves' foot jelly and barley water are valuable for bowel troubles, while foods of a starchy nature (*e.g.*, boiled rice or arrowroot) may be taken in cases of dysentery.

Rickets, a disease of young dogs, is associated with a deficiency of vitamin D, which controls the utilisation of lime by the body. The disease is more likely to develop in dogs shut away from sunlight. Cod liver oil is a valuable supplement to the food in cases of disease.

In general, the feeding of the dog is a matter of common-sense based on an elementary knowledge of anatomy. Obviously, in view of the vast differences in breed and size, and the many purposes for which dogs are used, it would be foolish to lay down hard-and-fast rules concerning diet. The fact remains, however, that the digestive process is the same in all types; and, whatever the breed, the aim should be to produce a sound constitution and the most perfect specimen of the type.—(*Tasmanian Journal of Agriculture.*)

Annual Report of the Chief Animal Husbandry Officer

FOR THE YEAR ENDING 31st DECEMBER, 1934.

By A. E. ROMYN, Chief Animal Husbandry Officer.

1. **Export of Chilled Beef.**—70,687 quarters of chilled beef were exported to the United Kingdom in 1934 as compared to 93,009 quarters in 1933. The decrease was largely due to the higher standard of quality required for export. This division provided similar grading and advisory services in connection with the export of this beef and in the selection and feeding of cattle as in 1933, though on a more extended scale. A great deal more work could, however, have been done had more funds been available for travelling and motor transport.

There were two serious breaks in the export of chilled beef this year, both due to outbreaks of foot and mouth disease.

The first outbreak occurred in July and interrupted the export of beef for a period of five weeks, the second outbreak occurred in December, and at the time of writing the export of all beef is prohibited by Veterinary restrictions.

The economic and psychological effects of these stoppages is very bad, and until the fear of further outbreaks is removed or unless the present Veterinary restrictions can be drastically amended, there is little prospect of building up an export trade of chilled beef of good quality. Under present conditions the trade will tend to degenerate into the spasmodic export of mostly grass-fed chilled beef during those periods of open transit to the ports which coincide with the flush season in this Colony.

Uncertainty has also been caused by lack of information about the long term policy of the United Kingdom Government in regard to the importation of beef and by the continuous weakening of the markets. According to returns in

this office the average gross weekly sale price of grass-fed chilled beef from this Colony for the period January to July was 2.75d. per lb. for sides and 3.53d. per lb. for sides for first grade chilled beef for the period September to December. On the basis of these prices and present costs of export and marketing producers in this Colony cannot carry on the trade without a subsidy. It is, therefore, not possible to speak with confidence in regard to the immediate prospects of the export of chilled beef from this Colony, though it is generally held that the Governments concerned must ultimately take measures to place this basic industry on a profitable footing.

When export was resumed in August last, after the first outbreak of foot and mouth disease, the Government decided to concentrate on the export of chilled beef of a better quality than had been exported hitherto. The results up to that point had shown that, in the present state of the trade, there was little hope of finding a payable market in the United Kingdom for veld fed bullocks from this Colony.

The payment of the bounty for the remainder of the year was, therefore, limited to first grade chilled beef which, in practice, consists almost entirely of beef derived from stall-fed bullocks or bullocks which have been fed grain on grass. To ensure a continuity of supply of bullocks of the quality required, the price of first grade chilled beef exported was fixed on a scale rising from 24s. 6d. per 100 lbs. dressed weight in August, to 27s. 6d. in December.

Considering circumstances, the response to these guaranteed prices was very good, though not as general as was hoped for, and over 5,000 "stall-fed" bullocks were exported during the period August to December, 1934. Very few bullocks of a similar quality had been exported in the whole previous history of this trade, and the reports on the general improvement in the quality of the beef and the reaction of the market are very encouraging. Supplies, however, ran short towards the end of the season. The last four shipments in December averaged about 200 head of bullocks apiece and show, as was expected, that critical months of supply in this trade are likely to be December and January.

A comparison of the average sale price realised for the thirteen shipments of chilled beef immediately prior to the raising of the grade in August and of the thirteen shipments immediately following the change with the average price of Argentine chilled beef in the respective periods shows that the spread in value between Rhodesian and Argentine chilled beef had been narrowed by approximately $\frac{3}{4}$ d. per lb. in the second period. In other words, the value of the beef had been increased $\frac{3}{4}$ d. per lb. by feeding. "Imperial beef," the better grade exported, frequently sold at within $\frac{1}{2}$ d. per lb. of Argentine chilled beef.

Under ordinary circumstances an increase in value of $\frac{3}{4}$ d. per lb. from feeding would be considered very satisfactory. The net price realised for chilled beef from this Colony was, however, too low during the period under review to give even at this increase a reasonable return to either the breeder or the feeder and the profits of both agents had to come entirely out of the subsidy. It should be pointed out in this connection that the higher the price of beef, the greater is the return per bullock to the feeder on this $\frac{3}{4}$ d. margin and the higher price he can pay for cattle for store cattle.

In the belief that the various "long time" control measures under consideration will be successful in raising the general price level of chilled beef, and in order to give the industry a fair chance to establish itself the Government has agreed to guarantee a range of minimum prices for the next three years. The scale proposed for 1935 rises from 22s. 6d. per 100 lbs. dressed weight for first grade chilled beef exported in January to 26s. per 100 lbs. in December. Provided the trade is not unreasonably handicapped by Veterinary restrictions these prices should ensure a fair profit to both the feeder and the breeder.

2. Subsidies.—During the past year the subsidies on chilled, frozen, boneless and extract beef have given the producer a reasonable return on the cattle sold for export and generally maintained prices on the local market.

These subsidies have, however, failed in one important object, and that has been to induce the breeder to improve his method of production and to buy better bulls. The largest

subsidy—the subsidy on first quality chilled beef—has gone almost entirely to the large feeders, and measures should be taken to ensure that a greater proportion of these funds get back more directly to the actual breeders of the cattle.

To this end I would recommend that an amount of not less than £5,000 be set aside out of the funds available for subsidies in the financial year 1935-36 for the general betterment of the cattle industry and more particularly for:—

- (1) Subsidies to approved pedigree breeders.
- (2) Subsidies for the purchase of approved bulls.
- (3) Short term loans to breeders to enable them to purchase feed to fatten their own bullocks where conditions are suitable.

Money placed in this way at the source of the cattle supplies will, I am convinced, be far more effective in securing the improvement required than subsidies paid to feeders who in many cases have not a permanent stake in the beef cattle industry.

3. **Pure Bred Cattle.**—Pure bred breeders have had a rather better time this year than last. The continuance of bad years has, however, so reduced the size and quality of the pure bred herds that any campaign for cattle improvement in this Colony will be badly handicapped by a shortage of suitable bulls.

The number of pure bred cattle reported in the Colony in 1930 was 15,395. This number, by the end of 1933, had decreased to 10,977. Though there may have been some difference in the method of reporting these returns, there is no doubt that there has been a considerable reduction in the strength of the pure bred herds in this Colony during the last three or four years. The deficiency in regard to pure bred bulls is as serious in the dairy breeds as in the beef breeds, but the numbers concerned are much smaller.

It is estimated that the production of pure bred bulls of good type in the Colony does not exceed 600 per annum, while the total number of bulls required to replace normal wastage in the European herds in the Colony is not less than 2,000 per annum. The improvement under the most favourable con-

ditions must, therefore, be a slow matter, and it has been recommended elsewhere in this report that measures should be taken to subsidise approved pure bred breeders to keep them in business and to ensure that as large a supply of bulls as possible will be available as needed.

The Africander and Red Poll breeds have been in good demand. In both cases the breeds in question are in danger from their friends. There is a tendency to buy Red Polls on conformation alone without proper attention to the milk records, and many bulls are sold as Africander which have little more in common with good specimens of that breed than their hump and red colour. It is of interest to report that one selected shipment of veld-fattened Africanders from Gwanda exported in July last sold at Smithfield at the highest price for grass-fed cattle from Rhodesia this year.

Some very useful Friesland bulls have been imported from the Union. Buyers of Friesland bulls just now appear to pay more attention to milk and pedigree records than the breeders of the other dairy or dual purpose breeds.

Three bulls—two good Red Poll bulls and one good Sussex bull—were imported from England under the assisted passage scheme.

4. **Experiments and Research.**—The controversy over breed policies continues. I must emphasise again the urgent necessity for a ranching station at which to test out the possibilities of evolving an indigenous or crossbred type of cattle more suited to present ranching conditions in this Colony than the types of the imported beef breeds in use and to attempt to develop an improved indigenous type of cattle suited to the demands of native husbandry in the Reserves. In this respect this Colony is behind most other semi-tropic cattle raising countries which are already experimenting along these lines.

I consider that definite provision should be made for breeding work of this nature and for more general feeding investigations in animal husbandry. The total provision on the 1934-35 Estimates for all these purposes is £50 for co-operative experiments.

It is unfortunate that it was found necessary to close the Gwebi farm, as this farm would have been invaluable at the

moment as a place at which to apply recent experience in established pastures and to study feeding problems in connection with the export of cattle and pigs and the management of mutton sheep.

A number of co-operative experiments are in progress dealing with:—

- (1) The feeding of iron salts.
- (2) The use of cod liver oil.
- (3) Molasses silage.
- (4) Established pastures on the Eastern Border.

On the whole the results of this work are not too satisfactory, as it is difficult to maintain the interests of all co-operators. Some useful general results have been obtained, however, and the work is being continued.

The Chief Animal Husbandry Officer has co-operated in the animal husbandry experiments carried out at the Rhodes Matopo Estate. I think it can be fairly said that the Matopo Experiment Station has given a lead to Matabeleland in the fattening of bullocks for export and that the protein and mineral experiments carried out at that Station are likely to be of considerable benefit to cattle ranchers. The work in the feeding of grain to bullocks on grass is of particular interest and has demonstrated that the cheapest method to fatten bullocks for export is by feeding some grain during the summer months while the cattle are on grass.

5. **Pig Industry.**—The main problem is still the question of markets.

Pig supplies were short early in the year and prices were good. In the latter half of the year an over-supply developed and poor quality pigs became unsaleable. The situation was aggravated by the closing of the Union and Congo markets through foot and mouth restrictions. The factories were unable to absorb all the suitable baconers offered, though they did not drop their prices below 3d. per lb. liveweight.

As a result of these low prices a number of producers disposed of their pigs for pork for what they would fetch. Others turned their pigs out to graze in the hopes that a rise in prices will occur in the next few months and that these animals can be brought in again for fattening.

This story of over and under production repeats itself with monotonous regularity, and is likely to continue until an export outlet is developed. Under present conditions the efficient producers make money in pigs over a period of years, and they are, in consequence, not altogether sympathetic to any form of close co-operation or organisation for the present. This attitude of mind, the usual obstacle to co-operation, ignores the many benefits to the Colony and, in the long run to these same producers, which would result from a larger and better organised pig industry based on a policy of more uniform values and discourages any permanent expansion of the industry.

During the year this Department despatched two consignments of frozen porkers to Great Britain to test the possibilities of that market. The first consignment met with a very favourable reception at Smithfield and was sold for prices which closely approximated the prices ruling at that time for New Zealand frozen porkers. The second consignment is in transit at the time of writing.

Neither consignment was specially selected. Each represented a fair sample of the better class of porkers produced in this Colony. The surplus of pigs in the Colony is, however, small and uncertain, and it must be realised that there is at present no chance of maintaining a continuous supply for export of the quality of pigs despatched in these consignments. If the results of these shipments are to be followed up, it will be necessary for pig producers to co-operate closely and increase their output. It would be, I think, to the mutual benefit of the various territories in South Africa to co-operate in the development of this trade.

For the time being, it will be necessary to subsidise the export of frozen pork. As subsidies go, such a subsidy would have considerable economic justification. At present prices, the amount required would be comparatively small. On the prices realised for the first consignment, a subsidy of 6s. to 9s. per pig exported from this Colony would be sufficient and could, for some time to come, be financed by the industry itself on lines similar to those adopted for butter.

From the standpoint of the maize farmer, it should be emphasised that each porker carries with it for this subsidy the equivalent of approximately $2\frac{1}{2}$ bags of maize valued at 8s. per pig as compared with four to five bags of maize in the case of a chiller bullock, which is subsidised to-day at the rate of approximately £4 per head. The production of porkers, moreover, fits better into the system of farming of dairy farmers and many small producers than does the fattening of bullocks.

It is encouraging to note the continued improvement in the quality of the pigs produced in the Colony despite the fluctuations in the market prices already referred to. Feeding methods have also improved and the use of meat and blood-meal, where separated milk is not available, is becoming more common.

In this respect the two shipments of frozen porkers seem to have effected considerable good. Co-operators in these consignments were required to feed their pigs along certain specified lines as far as possible. In some cases the results were striking when compared with the old feeding methods and acted as a telling demonstration to the producers concerned and to their neighbours.

The Large White Boar x Large Black Sow is being gradually adopted as the standard bacon or pork cross in the Colony wherever conditions are suitable for the white pig. There has been a shortage of Large White boars in the Colony, but during the year several breeders imported good Large White breeding stock from the Union and the shortage should not be so acute next year.

6. **Sheep Industry.**—The position of the sheep industry as a whole remains unchanged.

The year has not been a particularly satisfactory one. Wool prices have been well below the 1933-34 level, and the last two lamb crops on the Eastern Border have not been good. A few small flocks on the flats south of Gwelo have lost ground.

On the other hand, a lessening of competition from the South due, in 1932 and 1933, to currency difficulties and veterinary restrictions and later to drought conditions in the

Union, has given the local farmer a better show on the local market. Producers in Southern Matabeleland have made good use of the opening. It is estimated that approximately 80 per cent. of the total sheep killed in the Colony in 1934 were produced in this Colony as compared with approximately 7 per cent. in 1931. With better attention to detail, there is no reason why the local producer should not take over and retain practically the whole of the local market. Unless this attention is forthcoming, imports from the South are again likely to grow when sheep farmers in the Union have recovered from the results of the 1933 drought.

Sheep farming in Southern Rhodesia is so overloaded with pessimism that any improvement will come slowly. Individual farmers have repeatedly demonstrated, however, that with proper care sheep farming can be made a profitable side-line. One of the main drawbacks from the mutton standpoint is the general neglect of the young stock. As a consequence lambs are generally not ready for sale until three years old and are then thin, light and compare unfavourably in quality with importations from the South, and even with native sheep.

An Animal Husbandry Officer, Mr. R. H. Fitt, was appointed this year with special reference to sheep and wool work, and the Department has now the opportunity to work out a definite sheep and wool programme. Mr. Fitt has already visited most of the large sheep areas in the Colony and good effects from the advice given are reported.

During the present year his work has been chiefly to do with practical dosing demonstrations and advice in regard to parasitic control and general methods of better feeding and management of sheep.

It is hoped that more funds will be provided for extension work of this nature in 1935.

It is intended for the present to encourage the keeping of small flocks chiefly of the Blackhead type for mutton production in the drier areas of Matabeleland and in the agricultural areas of Mashonaland. On the Eastern Border, where the Merino has in most cases so far not proved a success, it has been decided to concentrate on instruction in better methods

of farming which, it is felt, will materially improve the position. At the same time experiments in wool and mutton production with crossbred sheep, which may be expected to stand the wet conditions of that area better than the ordinary Merino, will be carried out. The private importation of eight Romney Marsh rams was organised for this purpose this year. No breed, however, will overcome the natural disabilities of the country unless the sheep are regularly dosed and proper provision is made for the supplementary feeding of the ewes and lambs when necessary. Tentative arrangements have been made for the co-operative importation of Romney Marsh Merino and Blackhead Persian rams from the Union in 1935.

7. **Market Conditions.—Cattle.**—Conditions on the whole have not been unsatisfactory, though at one period prices on the Bulawayo market were very low. A very similar drop in prices in Bulawayo occurred in 1933.

The general situation has been relieved to a certain extent by the heavy drought losses which occurred during 1933. These losses practically removed the equivalent of one year's increase, and the winter losses this year in Matabeleland are reported as almost equally severe.

In parts of Matabeleland, especially in the Native Reserves, overstocking is now common, and unless provision is made for winter feed or the sale of the surplus cattle, heavy losses are to be expected in any severe winter.

The operations of Liebig's factory at West Nicholson, where approximately 26,000 head of cattle were slaughtered for export and the export from March to July of 10,701 head of cattle by the Rhodesia Export and Cold Storage Company, *via* Beitbridge to Durban, have had an appreciable effect in keeping down the readily saleable surplus of cattle in the areas in which the factory operates.

The prices paid for cattle by Liebig's varied from 2s. 6d. to 3s. 6d. per 100 lbs. liveweight, exclusive of bounty. The cattle exported *via* Beitbridge were purchased at approximately 10s. per 100 lbs. dressed weight, inclusive of bounty. Grass-fed cattle for export as chilled beef were purchased at 15s. to 17s. 6d. per 100 lbs. dressed weight during the first half of the year, depending on the bounty payable at the time.

The price of first grade bullocks ("stall-fed") for export varied from 24s. 6d. in August to 27s. 6d. per 100 lbs. dressed weight in December.

These prices from August to December were made possible by a subsidy of 1½d. per lb. on first grade chilled beef exported.

The average price of prime grass-fed cattle on the local market varied from 14s. or 15s. to 20s. per 100 lbs. dressed weight, depending on the time of the year. Prime stall-fed bullocks at Salisbury, towards the close of the year, sold up to 26s. and 27s. per 100 lbs. dressed weight. As a rule, prices in Salisbury have been higher than in Bulawayo.

For a brief period from May to July the Johannesburg market was open to cattle from this Colony and 2,208 head of cattle were shipped to Johannesburg. In order to prevent the diversion of chiller bullocks to Johannesburg an export tax of £1 per head was collected through the Rhodesian Railways on all cattle exported to the Union. This tax created a certain amount of opposition among farmers with bullocks and cows suited only to the Johannesburg market but, in the main, effected its purpose and not many bullocks suitable for export overseas were sent to Johannesburg. Legislative provision had also to be made to allocate the "Johannesburg quota" among different applicants. Every effort to re-open this market as soon as practicable must be made.

A logical development of the cattle industry, which veterinary restrictions has hitherto prevented, is the sale of Matabeleland store bullocks in the Union for feeding for export.

The distance from Beitbridge to Johannesburg by rail is only ninety-five miles greater than from Fort Victoria to Salisbury, and a trade of this nature should be of mutual benefit to both territories. Store bullocks sold in this way in Johannesburg would be moving continuously in the direction of the port and should actually be worth more to producers in this Colony than the present subsidised chiller for export.

A number of schemes for the control or better regulation of the local market have been brought forward during the year, but no scheme has so far been proposed which is considered practicable under present conditions.

Dairy Cattle.—The demand for dairy cattle has been quiet, but firm. Dairy bulls are badly needed, but farmers are short of funds to buy them. Cows in milk as usual sold very well during the winter months. High prices were paid during that period for dairy cows imported by dealers from the South. Many of these cows turned out badly and buyers seem slow to realise that heavy milk cows from the Union do not usually acclimatise quickly here and must be bought conservatively.

Pigs.—The market has again been extremely variable. The conditions predicted in my report for 1933 have unfortunately been realised. Prices for first quality baconers have varied from 3d per lb. to 5½d. per lb. liveweight, and the moderate improvement in the market, which occurred towards the end of November, has been discounted by the recent closure of the export market to the Congo.

Sheep and Wool.—There has been a ready demand for good slaughter sheep throughout the year and over £2 per head has been paid for fat lambs in Salisbury. The price of wool, however, has dropped considerably below last year's level, and it is estimated that the Melsetter clip has been sold at about 40 per cent. below the values realised for the previous clip.

Southern Rhodesia Veterinary Report.

FEBRUARY, 1935.

AFRICAN COAST FEVER.

Charter District.—Sixteen cases occurred at the Riversdale centre and six at the Greyling centre.

FOOT AND MOUTH DISEASE.

Salisbury District.—Infection spread to five farms adjoining infected centres.

Victoria District.—One extension only occurred.

TRYPANOSOMIASIS.

Eleven cases in Hartley, one in Lomagundi and three in Bubi District.

TUBERCULIN TEST.

One bull was tested on importation with negative result.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate.—Bulls 1, sheep 2,419, goats 190, pigs 15.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom *via* Union ports in cold storage: Chilled beef quarters, 3,379; frozen beef boned quarters, 82; frozen veal boned quarters, 166; frozen veal carcasses, 130; tongues, 1,042 lbs.; livers, 5,606 lbs.; hearts, 2,481 lbs.; tails, 1,430 lbs.; skirts, 1,411 lbs.; kidneys, 188 lbs.; sweetbreads, 84 lbs.

Meat Products.—From Rhodesian Export & Cold Storage Company.—Beef fat, 10,829 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 28. March, 1935.

The only species of locust reported in the Colony during March has been the Red Locust (*Nomadacris septemfasciata*, Serv.). The reports refer mainly to the hopper stage and only a few districts have been involved. The invasion is at the present time at a low ebb.

Eggs were reported to have been laid in the Urungwe section of the Lomagundi district by a swarm of fliers which crossed the Kariba Gorge from Northern Rhodesia at the beginning of the month, and did considerable damage to native crops. Fliers were also reported in the Sebungwe district at the same time and there also laid eggs and did some damage to native crops. On the 18th a swarm of fliers also appeared in the Bubi district, but no report of egg-laying was received.

All these swarms were certainly invaders from the north or north-west and it is difficult to account for swarms of this species in egg-laying condition at this time of year, long after the first invaders had laid eggs and perished.

Up to the end of the month no locusts are known to have matured within the Colony.

Operations have been prosecuted vigorously against hoppers in all accessible positions and, from available information, it would appear unlikely that any considerable number of flying swarms will develop in the Colony, although a small number are likely to appear from the remoter localities.

No records of *Empusa* or parasites were secured during the month.

It is noteworthy that the main incidence of breeding during the present season appears to have occurred in the lower veld of the northern part of the Colony, extending from Wankie district through Sebungwe, Lomagundi, Darwin and Mtoko to Inyanga. Nyamandhlovu and Belingwe districts sustained fairly severe attacks in certain parts. Elsewhere hatchings were light and scattered and some districts escaped almost entirely.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

MARCH, 1935.

Pressure.—Barometric pressure was slightly above normal at all stations during the month.

Temperature.—Mean monthly temperature was generally slightly below normal.

Rainfall.—The drought which started early in February did not break until the middle of March and the rainfall recorded was disappointing, in amount 2.0 inches as against a normal 4.4. The seasonal total to the end of March was 27.7 inches as compared with a normal 27.4 inches.

Rainfall in March 1935, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	N	
1	38	5	...	...	...	27	1	...	...	...	...	...	15	10	4	...	...	100	1	
2	14	...	...	...	...	...	...	...	19	46	7	3	14	10	...	...	...	...	...	...	...	22	6	8	...	5	154	6
3	1	...	...	...	...	3	46	3	...	3	4	1	...	...	...	84	22	3	...	...	1	10	3	...	...	...	...	...	64	60	6	18	332	8
4	1	1	1	...	...	...	...	...	...	59	9	11	6	3	...	...	15	...	...	1	6	5	30	35	1	...	184	2
5	1	...	...	7	...	...	7	5	12	5	18	...	21	29	...	...	1	8	23	...	...	...	137	2	
6	3	6	7	...	9	150	3	8	...	...	17	2	...	...	...	...	1	9	67	...	7	289	4
7	1	...	...	...	...	...	4	3	...	...	1	3	8	4	15	26	35	19	17	1	30	16	1	...	...	...	...	4	29	116	22	3	358	5
8	1	...	...	...	4	11	24	3	...	37	53	67	18	...	1	25	9	...	...	...	...	28	26	9	38	354	5	
9	28	20	6	...	...	15	12	2	...	...	86	4	1	...	...	...	...	3	68	...	30	275	4
10	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	32	9	4	...	...	...	...	20	69	2	5	150	3
Mean	3	...	...	...	...	5	6	2	2	21	34	10	5	10	5	21	8	...	...	5	9	11	37	3	7	204	4	

MARCH 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen *F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)		
	Mean	Normal	Absolute.			Mean.										Ins.	Nor- mal	No. of Days			
			Max.	Min.	Max.	Min.	Max.	Nor- mal.	Dry Bulb.	Wet Bulb.											
											Max.	Min.								Max.	Min.
Angus Ranch...	...	...	94	50	84.8	60.8	72.8	75.1	72.3	67.4	78	65	...	5.20	4.98	3	...		
Beit Bridge ...	964.6	...	98	58	88.8	67.3	78.0	...	74.8	65.6	62	61	4.2	2.01	1.61	2	1,500				
Bindura...	891.7	...	87	55	80.2	57.6	70.9	...	68.4	63.5	76	61	4.9	0.96	5.35	10	3,700				
Bulawayo ...	868.8	868.3	89	50	80.9	61.6	69.2	69.0	67.8	60.2	65	55	5.1	0.84	3.39	2	4,426				
Chipinga ...	892.9	...	88	55	75.8	60.1	68.0	...	65.4	63.2	81	61	4.4	3.77	8.51	14	3,685				
Enkeldoorn ...	857.8	...	85	50	77.6	57.0	67.3	68.7	67.6	60.6	75	58	4.3	3.32	3.75	4	4,788				
Fort Victoria ...	895.8	895.4	89	50	80.6	58.2	69.5	69.0	69.0	62.9	72	60	4.2	0.85	3.68	7	3,571				
Gwaai Siding ...	904.0	...	95	52	88.1	60.4	74.2	...	70.6	63.8	69	60	3.4	1.22	3.66	6	3,278				
Gwanda ...	906.4	...	95	58	83.3	62.2	72.8	...	70.1	62.4	66	58	4.4	2.51	2.04	5	3,229				
Gwelo ...	862.7	...	87	49	79.7	57.4	68.5	69.6	66.6	63.0	73	58	4.4	1.02	3.34	8	4,629				
Hartley ...	885.3	...	89	50	82.2	58.5	70.3	71.8	68.5	60.9	74	60	2.8	3.26	4.29	9	3,879				
Inyanga ...	836.5	...	80	46	73.7	54.4	64.1	...	63.4	58.4	68	54	3.1	1.79	5.91	8	5,514				
Marandellas ...	837.8	...	80	49	74.2	55.8	65.0	...	64.8	58.8	76	56	4.8	6.93	5.84	10	5,453				
Miami ...	878.9	...	85	53	78.7	59.7	69.2	...	68.5	63.0	74	60	5.0	2.16	5.49	5	4,090				
Mount Darwin ...	907.7	...	90	52	82.4	60.6	71.5	...	70.4	64.9	75	62	6.6	1.05	3.73	6	3,179				
Mount Nuza ...	...	...	72	45	61.5	49.9	55.7	...	55.6	54.1	91	53	7.3	9.53	...	22	6,668		
Mtoko ...	877.6	...	89	52	80.8	60.3	70.5	...	69.3	63.0	71	59	3.9	1.96	3.54	6	4,141				
New Year's Gift...	...	...	93	56	82.7	60.6	71.6	...	69.5	64.3	75	61	...	1.19	4.31	7	2,690		
Nuanetsi ...	962.4	...	98	56	87.1	63.4	75.2	...	73.7	66.4	69	62	5.6	2.01	2.77	4	1,581				
Plumtree ...	864.6	...	91	55	82.1	59.5	70.8	...	69.2	60.1	59	54	2.6	1.35	2.82	6	4,549				
Que Que ...	882.0	...	89	51	82.3	58.6	70.5	...	69.3	62.7	69	59	3.8	1.61	3.89	4	3,999				
Rusape ...	862.5	...	84	48	76.9	56.8	66.8	...	65.0	60.4	77	58	4.1	2.63	5.60	5	4,648				
Salisbury ...	854.9	854.4	85	46	78.4	57.0	67.7	68.6	66.5	60.7	72	57	5.3	4.53	4.53	13	4,885				
Shabani ...	908.0	...	93	56	83.3	62.7	73.0	...	69.9	63.9	70	60	6.1	1.06	4.93	5	3,193				
Sinoina ...	888.4	...	90	51	83.6	58.6	71.1	...	69.8	63.9	72	60	3.0	2.39	4.12	7	3,795				
Sipitilo ...	885.2	...	85	50	79.0	59.5	69.2	...	69.6	62.3	66	58	4.4	1.76	4.32	6	3,876				
Stapleford ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Umtali...	893.0	892.7	88	54	78.5	59.8	69.2	70.6	67.6	63.7	81	61	6.4	2.16	5.33	10	5,304				
Victoria Falls ...	...	...	98	58	90.9	64.6	77.8	...	76.4	64.8	75	62	2.2	0.54	3.17	7	3,672		
Wankie ...	930.6	...	96	66	90.7	68.6	79.7	...	70.4	66.7	61	61	...	2.54	2.91	3	2,567				

Departmental Bulletins.

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- No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.
- No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.
- No. 867. Agricultural Statistics for the Season 1930-31: (a) Live Stock; (b) Crops Grown by Europeans in Southern Rhodesia, compiled by the Government Statistician.
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REPORTS ON CROP EXPERIMENTS.

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- No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
- No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
- No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
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TOBACCO.

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- No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
- No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
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- No. 949. Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

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THE RHODESIA Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

JUNE, 1935.

[Vol. 6.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Tobacco Research Board.—During last month Parliament passed the Bill creating the Tobacco Research Board. The Board will consist of six members, *i.e.*, two representing the tobacco growers, two representatives of the tobacco buyers and two members of the Department of Agriculture. The functions of the Board are:—

- (a) to make recommendations to the Minister as to the land, buildings and other facilities which it considers necessary for the purpose of tobacco research;
- (b) to make recommendations to the Minister regarding appointments to the technical staff necessary for tobacco research;

- (c) to prepare and submit to the Minister annual estimates of expenditure for the purpose of tobacco research;
- (d) to initiate and approve all tobacco research investigations;
- (e) to call for progress reports in connection with tobacco research and to determine when and how such reports shall be made public;
- (f) to invite and receive donations from any person towards the expenses of tobacco research.

Funds for carrying out the research programme will be provided by Parliament, provided that any excess of £5,000 shall be met by the trust fund and the Government in equal shares. All sums obtained from outside sources will be paid to the trust fund which, at the beginning of this year stands at £1,000, consisting of £500 from the Rhodesia Tobacco Association and £500 from the Imperial Tobacco Company.

The Tobacco Research Board will thus take full responsibility for all research in tobacco in the Colony, including flue-cured, Turkish and fire-cured tobacco. It has been agreed to invite a representative of the Shamva Fire-cured Tobacco Growers' Association to attend any meeting the Board at which matters affecting that section of the industry are discussed

Farmers' Debt Adjustment Act, 1935.—This Act gives wide powers to the Land Bank Board to adjust farmers' debts, and a sum of £50,000, to cover the first year's working costs, has been provided on the Estimates. Under the Act any farmer whose estate is not under sequestration and is not assigned either under the provisions of the "Insolvency Act, 1924," or by voluntary private assignment may submit to his creditors and to lodge with the Board of the Bank a proposal in writing for the adjustment of his debts under the provisions of this Act.

If the terms of the proposal or any variation thereof are agreed to by—

- (a) the Board of the Bank;
- (b) all his secured creditors: and

- (c) a majority in number of his unsecured creditors, then such farmer may execute a deed of adjustment in which shall be embodied the terms of such agreement, and whereby he may empower the Bank to do, *inter alia*, all or any of the following :—
- (i) to supervise, manage and carry on his business;
 - (ii) to effect a composition with his creditors;
 - (iii) to realise his estate and distribute the proceeds thereof amongst his creditors.

On the execution of the deed of adjustment, the manager of the Bank shall forthwith publish notice thereof in the *Gazette* and in a newspaper circulating in the district in which the farmer resides.

The immediate effect of the publication of the notice of adjustment in the *Gazette* shall be—

- (a) to make the terms of the agreement, as embodied in the deed of adjustment, binding on all creditors of the farmer in respect of every debt which was due or the cause of which arose before the date of the lodging with the Bank of the proposal for adjustment;
- (b) to divest the farmer of his estate and to vest it in the Bank;
- (c) to stay all legal proceedings against the farmer for any liquidated claim provable against his estate, whereupon the taxed costs of such proceedings by the plaintiff may be added to his claim provable against such estate;
- (d) to suspend every other action and all proceedings therein against the farmer.

The Bank may, out of moneys appropriated by the Legislative Assembly for the purpose, make to an estate under adjustment such advances as it may deem necessary for the purposes of paying or compounding claims against such estate, for its administration and for carrying out the terms of the agreement and may in its own name on behalf of the Government take such security as the circumstances permit for the protection and recovery thereof.

When all the terms of the deed have been carried out to the satisfaction of the Bank, the manager of the Bank shall publish notice thereof in the *Gazette*.

Tobacco Research in Queensland.—According to the 1934 report of the Council for Scientific and Industrial Research the chief lines of investigation concerned tobacco diseases, curing tests, chemical investigations, date of planting tests, and smoking tests. Referring to "Frog-eye" leafspot, it is stated that the investigations this year have served to confirm the results obtained last season and show that "Frog-eye" can be checked by the application of control measures which are practical and effective.

The use of disease-free seedlings is the first essential, and in this connection the provision of clean seed is of prime importance. Seedlings grown from seed collected on farms where disease was prevalent during 1932-33 or 1933-34 developed the disease a short time after germination. Such plants constitute centres of infection from which the disease spreads throughout the seed-beds. Seed sterilisation with 1—1,000 solution of silver nitrate has been found effective, but the selection of disease free plants for seed purposes is strongly recommended.

The disease has been shown to persist over winter in leaves, so that seed-beds should be located at some distance from the barns, and old plants should be destroyed. Sterilisation of the seed-bed is a wise precaution.

Spraying trials were conducted from December, 1933, to June, 1934, using Bordeaux mixture, copper emulsion and colloidal copper, and all were effective in controlling the disease in the seed-bed.

Variations in methods of curing did not have any appreciable effect in reducing the incidence and amount of "Frog-eye" barn spot. The development of barn spots depends on the extent of the infection in the field, and the prevention of this aspect of "Frog-eye" lies in the adoption of methods of control for seed-bed and field.

The chemical investigations were mainly concerned with determining what are the most important factors responsible for poor smoking aroma in tobaccos. Although but recently commenced, results to date indicate that the degree of alkalinity of the smoke decreases as quality is higher, the high grade smoke being faintly acid to litmus and the low grade distinctly alkaline. Low grade tobaccos also give comparatively large amount of tarry matter on burning, and the smoke from these low grade samples contains appreciable quantities of hydrogen sulphide, while better samples give only very faint traces.

British Government's Agricultural Policy.—During March, 1935, a deputation from the National Farmers' Union interviewed Major W. Elliot, the Minister of Agriculture and Fisheries, on the subject of the Government's policy.

Mr. Elliot said he welcomed the opportunity afforded by the deputation of dealing more fully with some important aspects of Government agricultural policy on which pronouncements had recently been made. The policy of His Majesty's Government with regard to agriculture could be very simply and briefly stated. It was to encourage the maximum supply of foodstuffs to the consumers in our markets at the lowest price consistent with the reasonable remuneration of the home producer. Mr. Elliot said he desired in the first place to emphasise the closing words of that statement. The policy of His Majesty's Government laid down as a fundamental point the necessity of securing a reasonable remuneration to the home producer. Any speeches, any declarations, must be read in conjunction with that. In the second place, he desired to point out again what he was sure all of those present would agree, that the second great object was equally essential, namely to encourage the maximum supply of foodstuffs to the consumers in our markets at the lowest prices consistent with that policy.

Each of these objects had been emphasised by Ministers in recent weeks. The importance of the consumer aspect was stressed by Lord De La Warr in his Dorking speech. The importance of the maintenance of remunerative price-levels had been stressed by the Government as a whole in the recent

White Paper on the Imports of Meat into the United Kingdom (Cmd. 4828), a declaration of general policy second to none in importance.

Reasonable remuneration for the producer and close attention to the needs of the consumer were objectives not conflicting with, but supplementing, each other. The Wheat Act had proved that it was possible to safeguard the home producer from the full impact of world economic conditions while maintaining food prices at a level which gave the consumer practically the full benefit of the enormous supplies pressing upon the world markets to-day. Clearly it was to the advantage of all of us if this could be done.

The principle of the Wheat Act was not universally applicable. It was clearly applicable, however, in the case of meat and live stock, and as the deputation was aware the Government not only acquiesce in but desire to apply the levy principle in the case of the live stock industry as soon as they are in a position to do so. Whether it could be applied in the case of some other commodities was a question well worth exploring. The Government had never held the view that quantitative regulation was necessarily in all cases the most appropriate method of assisting the home agricultural industry.

Referring to the policy on live stock developed in the White Paper Mr. Elliot emphasised the fact that it was accompanied by the most explicit assurances to the home producer, in particular, the statement:—

“It is the firm intention of His Majesty’s Government in the United Kingdom to safeguard the position of the United Kingdom live stock industry.”

Mr. Elliot said that as he had stated earlier in general he then stated again in particular, that the whole statement of policy must be read in the light of these declarations.

Empire Co-operation in Research.—The fifth annual report of the Executive Council of the Imperial Agricultural Bureaux, obtainable from His Majesty’s Stationery Office or from offices of the Council, is of special interest both to agricultural research workers and to those who watch the development of common services, jointly financed by all

Governments of the Empire and jointly controlled by their accredited representatives. Consequent on the recommendations of the Imperial Committee on Economic Consultation and Co-operation (1933), whose report was unanimously accepted by all Governments, the Council, in addition to its previous duties, was entrusted with the administration and financial control of the Imperial Institute of Entomology and of the Imperial Mycological Institute, and also was authorised to submit proposals from time to time for co-operative action in regard to scientific research schemes.

Ten centres for the collection and dissemination of information on scientific agricultural research, dealing respectively with Entomology, Mycology, Soil Science, Veterinary Science, Animal Health, Plant Genetics, Herbage and Non-Herbage Plants, Fruit Production, Animal Genetics and Animal Parasitology, are now under one common administrative control. The story in regard to each one of these branches is the same—increased use by research institutes and research workers throughout the Empire of the information services made available. Special prominence is given in this year's report to the work and finance of the Institutes of Entomology and Mycology. Over 2,000 specimens a week (many of them, of course, duplicates) are received by the former and identifications for entomologists in all parts of the Empire were made at an average rate of 170 a week.

The Parasite Laboratory, started by the Empire Marketing Board for the collection, breeding and despatch of beneficial parasites required by entomologists in their efforts to combat insect pests, has passed under the control of the Council and draws common financial support. It despatched, mostly to Canada and New Zealand, $1\frac{1}{4}$ million beneficial parasites, or nearly four times as many as in any previous year. Other research activities aided co-operatively through Council included research into the methods of control of pests infesting produce stored in enclosed spaces, and the Low Temperature Research conducted under the Department of Scientific and Industrial Research.

Mr. C. A. Berrett goes to London.—Some four years ago it was decided that in the interests of the Southern Rhodesia Tobacco Industry a representative of the growers should be

stationed in London. No definite action could be taken, however, until the question of finance and the creation of a suitable organisation of the Tobacco Growers had been satisfactorily settled. In due course there was introduced the "Tobacco Levy Act," which in effect provides funds to be expended in furthering the interests of the Tobacco Industry as a whole. The Rhodesia Tobacco Association was remodelled and became the officially recognised authority for disbursement of the Tobacco Levy Fund.

Owing to the abolition of the Empire Marketing Board's publicity work the question of having a grower's representative in the United Kingdom was rendered all the more imperative. The representative will have as his sole objective the expansion of the market for Southern Rhodesia tobacco, and to this end he will co-operate with the High Commissioner's Office in London. Furthermore, the representative will establish personal contact with both manufacturers and brokers and so link up with producer with the relative interests overseas to their mutual advantage.

The growers will then be kept in closer touch with matters effecting market demand and manufacturers' requirements and *vice versa*, the Tobacco Trade will be kept fully conversant with developments regarding the producing side of the industry. Stated briefly, the intention is to endeavour to stimulate the demand for Southern Rhodesia tobacco in the United Kingdom, and in so doing co-operate to the highest degree possible with the tobacco manufacturers, tobacco brokers, and the trade generally. Existing trade channels will be utilised to the fullest extent possible.

The appointed representative will not be expected to handle the actual sale of tobacco and will, therefore, not usurp the functions of tobacco brokers. It is felt that the greater the degree of co-ordinated effort which can be effected between the tobacco growers on the one side and the tobacco trade on the other, then the greater will be the progress registered to the mutual satisfaction of all whose interest lies in the development of the Southern Rhodesia tobacco industry.

Mr. C. A. Berrett, former manager of the Lytton Estates, has been appointed to this post, and is expected to enter upon his duties early this month.

Treacle for Silage and Stock Feed.—A number of farmers who are anxious to test silage made with treacle have been concerned with the heavy cost of railage. The following letter from the General Manager of the Railways, dated April 26th, will therefore provide welcome news:—

“I have pleasure in advising you that as the result of representations made to me, it has been decided to make a very substantial reduction in the rate charged over these lines for treacle used for stock feeding or tree spraying purposes.

2. With immediate effect treacle declared on the consignment note to be for stock feeding or tree spraying purposes, will be charged at the rates under Tariff 12 when consigned in minimum quantities of one ton, and the revised rates from Beira to the chief points in Southern Rhodesia as compared with the rates previously in force are as follows:—

From Beira to	Old rate	New rate
	Tariff 10. Per ton. s. d.	Tariff 12. Per ton. s. d.
Umtali	56 0	16 9
Salisbury	95 0	24 8
Gwelo	111 8	33 9
Umvuma	116 8	36 1
Fort Victoria	125 0	39 4
Shangani	113 4	35 8
Lochard	113 4	37 0
Bulawayo	113 4	38 10
Gwanda	118 4	41 6
West Nicholson.....	121 8	42 4

I trust that the reduced rates will be found to be of material assistance to the farming community of the territory.”

NOTICE.

TUNG OIL FRUIT (CLUSTER TYPE) REQUIREMENTS, 1936.

To enable the Department of Agriculture and Lands to ascertain in advance the requirements of intending growers of Tung Oil (*Aleurites fordii*) during the year 1936, farmers and others are invited to furnish their requirements under this heading to the undersigned not later than 31st August, 1935.

It is estimated that the cost of Tung Oil seed in fruit form to consignees' stations or sidings will be approximately 2s. 3d. per lb. of fruit for the year in question, but no definite assurance can be given at this date that the above cost will not be exceeded.

Orders should be accompanied by cash or cheques endorsed by the Bank and made payable to the Accountant, Division of Agriculture and Lands, Salisbury, on 1st January, 1936.

The Government only accepts orders and cash deposits on the clear understanding that no legal liability shall attach to the Government if it fails, for any reason whatsoever, to fulfil the whole or any portion of an order.

Applicants will be held liable for the cost of their requirements if between the date of application and the date of delivery they decide to withdraw their order.

Whilst every endeavour will be made to supply the full requirements of applicants, no guarantee will be given that such quantities will be available. If it is found that supplies

of seed will not enable this Department to meet in full the orders placed with it, the Department reserves to itself the right to make a *pro rata* distribution of seed in fruit form.

Tung Oil seeds are sold in fruit form to assist in the preservation of the seeds' viability.

There are approximately 76 seeds per lb. of fruit, and a germination percentage of about 50 may reasonably be expected while the seed is fresh. No guarantee is, however, given.

Under normal circumstances, fruit should be available for distribution about February, 1936.

H. G. MUNDY, Secretary,
Department of Agriculture and Lands.

Preparing the Blackhead Persian for the Show.

By R. H. FITT, Animal Husbandry Officer.

Success in showing often depends on how the sheep are prepared for exhibition. To achieve the best results a start should be made at least 8 weeks before the Show if the sheep are in good condition; if not, an earlier start should be made.

Selection.—The animals must be carefully selected for the various classes, making quite sure that there will be no ground for disqualification. Incorrect age and breed blemishes are frequent reasons for disqualification.

Breed Disqualifications in Blackhead Persian Sheep.—White spot on the head; wool or black spots on the body; horns; visible white spots on the black skin of the tail; grey colouring on the tail or legs of a two-tooth sheep—a few grey hairs on the tail or legs of an older sheep need not necessarily disqualify

Feeding is most important. A suitable area of good grazing with shade and a supply of clean drinking water near at hand should be reserved for the Show stock. This grazing should be supplemented with a grain ration. The following are some suitable concentrate rations:—

- (1) 80 lbs. crushed maize.
20 lbs. groundnut cake.
3 lbs. mineral mixture.

Feed 1 lb. per head per day of the mixture in addition to the grazing.

- (2) 80 lbs. nyouti.
20 lbs. groundnut cake.
3 lbs. mineral mixture.

Feed 1 lb. per head per day of the mixture in addition to the grazing.



- (3) 2 lbs. bean hay.
 $\frac{1}{2}$ —1 lb. crushed maize.
 $\frac{3}{4}$ oz. mineral mixture.

Feed $\frac{1}{2}$ —1 lb. grain per day plus the hay. This ration is valuable when the grazing is poor.

- (4) 70 lbs. maizemeal.
 10 lbs. bloodmeal, or 15 lbs. meatmeal.
 4 lbs. mineral mixture.

Feed 1 lb. per head per day of the mixture in addition to the grazing, as the meatmeal or bloodmeal is not so palatable for sheep.

Feed No. (4) may not be taken to as readily as the others. It may, therefore, be necessary to start with less bloodmeal or meatmeal and gradually increase to the full amount.

Mineral Mixture:—

- 6 lbs. bonemeal.
3 lbs. salt.
2 lbs. scrap tobacco (coarsely broken up).
 $1\frac{1}{2}$ ozs. sulphate of iron.
 $\frac{3}{4}$ oz. copper sulphate.
4 ozs. flowers of sulphate.

General.—It is advisable to start feeding the concentrated ration gradually and work up to the full ration in about 5 to 10 days.

Succulents.—When the grazing is poor and silage, majordas or pumpkins are available as feed, any one of these can be given as a supplement to any of the previously mentioned rations. They should be fed in the following quantities: Silage 2-3 lbs. per day, pumpkins or majordas broken or sliced 4 lbs. per day.

If it is proposed to feed the sheep in pens give any of the previous mentioned rations with one of the succulents plus hay or maize stover *ad lib.*

The Coat and General Appearance.—To bring out the under coat, to give the desired silky, smooth appearance, and to kill vermin that may be present, it is advisable to dip the sheep in a recognised sheep dip (containing sulphur) mixed in soft

water. This dipping should be done about 5 weeks before the Show. Later the animals should be washed in slightly warm water with a little washing blue added and using soft soap. Washing should commence 2 weeks before the Show and be done every third day, providing the weather is suitable. The last washing should take place on the day before judging. On the days between washing a curry comb should be used; after a curry combing the animals should be thoroughly brushed down to remove all loose hair and wool.

If the sheep are housed or kraaled at night, keep the houses or kraals clear of dust and manure. If possible bedding should be provided.

Keep up the regular system of dosing, but do not feed the concentrate ration on the day that dosing with Government Wire Worm Remedy is done.

Avoid driving the sheep in the heat on the day.

Give sheep a drink of water before judging, but be sure that they are back in their respective pens before the catalogued time for judging.

The Relation of Grass Cover to Erosion Control.

By H. H. BENNETT, Director, U.S.A. Soil Erosion Service.

This article contains so much information of direct concern to Southern Rhodesia that it has been taken over in full from the March, 1935, number of the *Journal of the American Society of Agronomy*.—Editor.

Much has been said and written about the powerful effect of forests, in controlling erosion and increasing absorption of rainfall, but not nearly enough attention has been devoted to the similar and almost equal effect of grass as a stabiliser of land and as an effective means of increasing absorption. The importance of grass as a means of controlling erosion is so great that this paper may appropriately be prefaced with the assertion that where there is a good cover of grass there is no serious problem of erosion. For this reason it seems time for agronomists and all of those who are interested in the continuing welfare of the crop and grazing lands of the nation to think more of ways and means for increasing the use of grass, and those other thick-growing crops that function after the manner of grass, to the end that by this simple procedure more of the water may be retained where it falls, with less of it running rapidly into the streams, and with more of the soil held in sloping fields where it belongs.

The results of careful measurements of the runoff and erosion from representative areas of 12 major soil types throughout the country show on the average that where grass, or a similar dense crop, is grown five times more rainwater is absorbed and 65 times less soil is washed away as compared with the losses of soil and water from exactly the same kind of land, occupying the same slope, and receiving the same rainfall where clean-tilled crops are grown. These measurements have been made from about the average slope of the

soil types involved, and they represent annual losses over a period ranging from 2 to 4 years. In one instance, that of the Colby silty clay loam of western Kansas, the average annual loss of soil from an area devoted to a clean-tilled crop (kafir corn) has been 3,300 times greater than on the same type of soil, occupying the same slope and situated at a distance of only a few feet, where the surface was thickly covered with a native growth of bluestem and grama grass; while the loss of water as immediate runoff has been 437 times greater from the clean-tilled area than from the one covered with grass. The losses from some of the other extensive soils have been quite in line with those of western Kansas.

Soil and Water Losses.—For example, on an 8% slope of the Shelby silt loam in the rolling part of the north Missouri corn belt, the average annual loss of soil over a 3-year period has been at the rate of 60.8 tons per acre, along with a loss of rainwater as immediate runoff amounting to 27.4% of all the precipitation; whereas, from the same degree of slope on the same farm the corresponding losses from Selby silt loam under timothy grass have been at the rate of 0.32 ton of soil annually and 7.7 of the rainfall. Where the ground was kept bare the corresponding annual losses have been at the rate of 112 tons of soil per acre, along with 26% of the rainfall. Inasmuch as the average depth of soil under the virgin prairie condition of the Selby silt loam of this locality is approximately 7 inches on 8% slopes, only about 20 years would be required to remove the entire surface layer where corn is grown continuously. Where the ground is kept bare only 11 years would be required to remove the surface layer; but under grass 3,890 years would be required to remove the same depth of soil and under alfalfa 5,845 years would be required. In other words, in this region the probability is that soil builds up from beneath about as fast as it is removed from the surface under a good cover of grass or a good cover of alfalfa.

On February 23, 1934, the most astounding losses of soil occurred in the vicinity of Santa Paula, Calif., as the result of a heavy rain. On 17 farms where measurements were made immediately after the rain, it was found that steep slopes used for clean-tilled orchards had suffered acreage losses of

soil ranging from 150 to 525 tons. That there were no measurable losses from the same kind of land on the same farms where the surface was covered with native vegetation is probably one of the most outstanding instances that we know of showing the utterly indispensable place that grass and other forms of stabilising vegetation must be given in any plan having a chance to accomplish anything approximating permanency in our programmes of erosion prevention and control.

Combination of Control Methods.—It is unfortunate that some specialists have taken the position that erosion can be effectively controlled with a single engineering method of attack, namely, terracing. Terracing (the American type of terracing represents a broad embankment adjusted to slope contours) is generally an effective method for reducing erosion on slopes which especially in case of shallow soils with impervious subsoils, do not exceed about 6 to 10% in declivity, depending on the kind of soil, the degree of erosion as the result of past land use, the intensity of rainfall, and the type of agriculture. Supported by strips of grass, lespedeza, Sudan grass, or other adaptable thick-growing crops, terraces can be helpfully employed on somewhat steeper slopes, especially on those where the soil is deep and absorptive. This method for diverting water must also be recognised as a useful practical measure for carrying water from the upper sides of sharp, erosive slopes to safe drainage ways.

Relation of Grass to Land Desiccation.—During the summer of 1934 numerous ranchers asserted publicly and privately that during the past 15 to 20 years, following the steady depletion of the grass by overgrazing, more and more springs have gone dry and numerous streams which formerly ran for considerable periods or throughout the year now carry water only for short periods following rains or the melting of snow. These complaints were frequently heard in Utah and southern Idaho. They were in some measure suggestive of what C. W. Hobley, a man of long experience on the continent of Africa, recently had to say in discussing the effects of overgrazing in East Africa. Mr. Hobley says, "We are thus confronted with the paradoxes that tsetse fly is a blessing and water a curse. Where there is water, cattle are concentrated; they eat the grass—seeds, roots and all. With increase of cattle the soil

is progressively removed and erosion sets in. To-day, two-thirds of Tanganyika are under the tsetse fly, and in that two-thirds erosion merely follows the slow natural course. There is no doubt that two-thirds of Tanganyika have been preserved by the fly from erosion and ruination at the hands of the native population."

It might be well to quote here part of a letter recently received from K. S. Sandford, Field Director of the Oriental Institute's prehistoric survey in north-eastern Africa. Dr. Sandford says, "... the boundaries of the Nile are absolute desert, except within a few miles of the coast and in the Sudan. There is reason to suppose that the coastal belt provided grazing for larger flocks in ancient times than it now does (the Oriental Institute can cite many inscriptions on this point): the coastal belt was the best wine-growing country in Roman times. There is a strong feeling among most of those who have studied the subject that the present state of affairs on the coast is due to (1) destruction during and before the Arab invasion, (2) extreme neglect since the event, *i.e.*, for about 400 years, (3) perpetual grazing by goats, the most destructive animal in the world, and grazing of even the most sparsely vegetated regions by camels. It was the Arab who introduced the camel in large numbers into the country. To these factors rather than to any change of climate in the coastal belts is attributed the present state of affairs."

"The northern Sudan from Darfur to the Nile is experiencing a serious encroachment of desert from the north: ... there is similar trouble with the fringes of the Kalahari and in northern Nigeria. In the arid or semi-arid Sudan also there is observable failure of formerly reliable wells. Some believe that these things are due to an arid period of a climatic cycle, which may be long or short. If you consider that since 1898, when settled government was given to the Sudan for the first known time in history, there have been no major losses of people or cattle, that the people and their flocks have increased by very many millions, that they have continued to live in country with 10-15 inches of rain and a tropical sun, and that they have done extensive cultivation, I think you can see that there may be something in common with your problems. If, now, you turn to Africa south of the Sudan, you see over-population, over-grazing, over-culti-

vation of exceedingly soft soil that washes away with the over-abundant rains (and will blow away, as in the Sudan, when it is dry). The result is appalling and forms perhaps the greatest problem of British administration in Africa. There is no serious suggestion of total failure of rain in this case."

A survey of a representative farm in Trego County, Kansas, where there was both eroded and uneroded land, made by R. H. Davis in 1931, shows that on this 159-acre farm, consisting in its upland portion of Colby silt loam that was broken out of the original plains grass in 1922, the principal erosional losses from 106 acres of cultivated upland were as follows: 29.3% had lost 3 inches of soil, 28.8% had lost $4\frac{1}{2}$ inches of soil, 33.9% had lost 8 inches of soil, and 0.5% had lost 2 feet of soil and subsoil.

All the eroding areas where losing soil at a strongly accelerated rate, as compared with the areas still retaining a cover of plains grass, and all of this eroded land had suffered markedly in productivity. The most severely washed areas had become excessively droughty and had very little value for the regional crops. The exposed subsoil and the slope was essentially identical with subsoil which, at the Hays (Kansas) Experiment Station, produced on an average of 4.8 bushels of wheat as against an average of 25.2 bushels produced on the practically virgin soil in the same field where the slope and the methods of culture were identical. Here the soil loss from the virgin area has been at the rate of 2 tons an acre and from the corresponding subsoil at the rate of 11 tons an acre, with corresponding water losses of 10 and 19%, respectively.

It is interesting to note in this connection that the vegetation on the typical virgin soil of the Trego County area, which completely covered the ground, consisted of 85% of grasses (buffalo, little blue-stem, and blue grama) and 15% of weeds; while that on the eroded soil, originally the same, after 2 years of abandonment consisted of no grass, 2% weeds, and 3% old Kafir stubble, with 95% of the surface bare. In other words, there had been a switch from a 100% ground cover of vegetation to a condition of 95% of non-vegetated surface, with not a single plant on the abandoned eroded area that was found in the original cover.

More Vegetative Methods of Control Needed.—The evidence is sufficient to convince anyone that vegetation must be brought more and more into our plans for controlling erosion. One of the principal curses of the American type of agriculture is continuous clean cultivation of sloping erosive land. The decreased productivity and ultimate depletion of most of these lands with the continuation of such usage, is not a matter of opinion but a pre-determined physical fact. In other words, if we are to preserve the body of our soils we must, as speedily as possible, change our farm methods on rolling land in a very marked way. We must practice more crop rotations; we must to an increased degree keep the land covered with thick crops at certain seasons of the year; we must bring strip cropping more into use; and numerous areas of steep, highly erosive land must be stabilised with grass, lespedeza, trees, or other soil-holding crops. In many fields these vegetative practices can be introduced and are being introduced in a practical manner and with the full approval of farmers where the farmer has been shown why and where they should be adopted. This can be accomplished in many instances either by demonstration or through the medium of a map showing the precise physical conditions of a farm and the relation of these conditions in various parts of a farm to their needs. In the programme of the Soil Erosion Service, now being applied to many millions of acres, this is one of the basic procedures.

Plan of Procedure.—The method of attack employed by the Soil Erosion Service is essentially a co-ordinated plan of correct land use. This plan involves not only the use of direct methods of retarding erosion (which necessarily calls for retardation of runoff by increasing absorption of the rainfall), but the use of indirect methods, such as the retirement from cultivation of steep, highly erosive areas from which accelerated runoff (resulting from incorrect land usage) descends with destructive effect upon lower-lying cultivated areas. Such retired critically vulnerable lands are being planted with thick soil-holding crops, such as trees, grass, alfalfa, lespedeza, sorghum, and clover.

Part of the cultivated land is being protected with the new system of strip cropping, under which clean-tilled crops, such as cotton, corn, and tobacco (the real producers of

erosion), are being grown between parallel bands of grass, lespedeza, sorghum, and other dense crops planted across the slopes, on the level, *i.e.*, along the contours. These latter crops catch rainwater flowing down the slopes, spread it out, and cause the suspended soil to be deposited and most of the water to be absorbed by the ground, thus protecting the crops growing on the ploughed strips below. On certain slopes strips of permanent protective cover will be planted according to the French system, using trees, shrubs, and vines. Here is an opportunity to make advantageous use of nut trees, persimmon, honey locust (producing feed for livestock), briar crops, and other plants of economic value. It is hoped that it may be possible on some of the project areas to employ the Ecuadorian system of protecting steep slopes by bordering the downhill sides of rectangular fields with soil-holding hedges.

Field terraces (embankments adjusted to the contours) are being employed where applicable, and in some localities it is planned to scarify certain types of lands, especially summer-fallowed ground, with a machine which scoops out 10,000 basin-like holes to the acre, each of which retains about 5 gallons of rain, causing it to sink into the ground where it falls. Machines for this purpose are now being manufactured. Soil-conserving crop rotations are being practised and cover crops and other control measures are being employed.

Every farm is surveyed in advance of actual work by specialists of the local erosion staff. Soils, slopes, and extent of erosion are plotted on accurate maps. With the aid of this, the farmer, the erosion specialists, and the crops, engineering, and other specialists go over the farmstead, study it in detail and on the ground plan a course of procedure by assigning each acre to a particular use in accordance with its needs, adaptability, and appropriate place in a carefully planned, co-ordinated land-use programme for that particular farm. The work is carried out on a strictly co-operative basis with the farmers. Generally, the latter are enthusiastically supporting every phase of the programme. On some of the projects more than 95% of the farmers are going along with the programme of the erosion specialists, agreeing to far-reaching reorganisation of their fields and farm procedures. For example, on numerous farms fences are being relocated

so as to permit contour cultivation, terracing, strip-cropping, the inauguration of soil-building rotations, and the planting of the more vulnerable slopes to grass, trees, etc. Such hearty co-operation, it is believed, ensures the success of the programme. By putting through these initial educational watershed projects in a highly impressive manner, it is felt that it will then be possible to extend the work to all areas through the Extension Service, the colleges of agriculture, State experiment stations, and other organisations, with the assistance of erosion specialists when necessary.

First Co-ordinated Erosion-Control Effort.—Here is the first attempt in the history of the country to put through large-scale, comprehensive erosion and flood control projects, such as apply to complete watersheds from the very crest of the ridges down across the slopes to the banks of the streams. These are not engineering projects, or forestry projects, or cropping projects, or soil projects, but a combination of all these, operated conjointly with such reorganisation of farm procedure as the character of the land indicates as being necessary. This procedure is based on the best information in the possession of scientific agriculturists, agronomist, forester, range specialist, soil specialist, erosion specialist, agricultural engineer, economist, extension specialist, game specialist and, geographer. It is the application of accumulated knowledge pertaining to the great multiplicity of variables affecting the three-phase process of absorption, runoff, and erosion employed not as single unco-ordinated implements of attack, but collectively, according to the needs and adaptability of the land, in a combination of integrated control measures, supplemented by new information accruing from the experience of combat.

No such co-ordinated attack has ever before been made against the evil of erosion in this country. Considering the physical, economic, and social factors involved, it is believed there is no other possible practical method of ever making any effective headway against this vicious problem. Even if the Government owned the land, it would still have to be used over large areas in the production of crops and for grazing: and here again precisely the same physical problems would

have to be met and conquered, an eventuality that unavoidably precedes all other consideration relating to correct land use.

Examples of Procedure.—In the Wisconsin erosion project covering Coon Valley near La Crosse, for example, some of the steep timbered areas, now eroding because of excessive grazing, are being taken out of use and given complete protection in order to stop the excessive runoff of rainwater, which has been speeding down across the cultivated slopes, ripping them to pieces with gullies or planing off the more fertile topsoil. Grass is being restored to these protected forest areas, and where the trees are too thin other trees are being planted. Small plantings and seedings are being made that furnish feed and cover for quail and ruffed grouse. Eventually, with increased stocks of these fine game birds, saved from starvation during prolonged periods of snow, as was done last winter, sportsmen will come from Milwaukee, St. Paul, Chicago, and other places to pay the farmer for the privilege of hunting in his timbered lands.

Below the forested land, the steep slopes now washing rapidly to a condition of low productivity are being taken out of the clean-tilled crops and put into permanent pasture to furnish the grazing that formerly was provided by the timbered areas. The grazing capacity of the farms is not thus increased or materially decreased, but the crop area is cut down to some extent. Better protection of the cultivated land from erosion will largely make up for this reduction by way of higher acreage yields.

On the 150,000-acre watershed erosion project on Big Creek in north-central Missouri, extending into south-central Iowa, a report of progress submitted by the regional director of the soil erosion work, under date of June 23, 1934, includes the following highly pertinent statement with respect to accomplishment, work having begun on this area in the spring of 1934: "At this time we have 401 co-operative agreements signed up with the farmers of Big Creek project, and over 63,000 acres of land under contract for a co-ordinated plan of erosion treatment. We have been successful in reducing the corn acreage over the next 5-year period by more than 37 per cent. on these farms. We have cut the acreage of land

where corn follows corn for a second year (a very bad practice) more than 54 per cent. We have very materially increased the acreage of pasture. We are planning an intensive programme on pasture improvement, beginning this fall and continuing into next spring. While weather conditions have been quite unfavourable, it is felt that very good progress has been made to date."

Thus, all indications point to successful achievement with these co-ordinated, educational programmes of erosion control—which, it should be emphasised in conclusion, are of an experimental-demonstrational nature, and which, by reason of the necessary procedures involved with the accomplishment of a complete job, extend beyond the mere task of controlling erosion.

Conclusion.—In conclusion, it should be emphasised again that a successful programme of erosion control is going to call definitely for battling for more grass, more dense soil-stabilising crops, and better adjustment of farm procedures to the physical characteristics of the land. The agronomist must hold a key position in this battle. It is hoped that he will distribute his forces so as to push the line of attack to every position needing attention.

"Ephestia Elutella" in Rhodesian Tobacco.

The study of this important subject is being continued at the Slough Stored Products' Research Station by Professor Munro, of the Imperial College of Science, and the following extracts from Professor Munro's Report for 1934 will be of interest.

1. **Laboratory Work.**—The experimental work relating to the infestation of tobacco has followed similar lines to those of the dried fruit work. A special study has been made of hydrocyanic acid gas as a fumigant for tobacco, particularly with reference to residues remaining in the tobacco and their effects on aroma, flavour and smoking qualities generally. The results of the work show that the normal dosages given for tobacco fumigation are too low to penetrate fully into bales and hogsheads at a concentration lethal to all stages of *Ephestia*. Higher dosages can, however, be given without affecting aroma, flavour or smoking qualities. On the other hand one of the more important tobacco manufacturers hesitates to use hydrocyanic acid in this country, and has asked that ethylene oxide be further investigated for this purpose. This work is being undertaken.

The work done has included actual fumigation experiments, especially to determine the penetration of the gas in bales and hogsheads and also to ascertain the amount of residual hydrocyanic acid left behind on fumigation at high concentrations.

As has already been explained, infestation of warehouses is a most important problem, and special experimental work has been undertaken to determine whether the insecticidal spray used in the dried fruit warehouses can be safely used in tobacco warehouses where taint from the oil might have been feared. It is satisfactory to report that this spray can be quite safely used in tobacco warehouses and that it has been approved by one of the big tobacco combines. Experiments

have also been carried out to ensure that no fire risks attached to the use of this spray, and here again results are wholly satisfactory.

2. **Field Work.**—The field work carried out in the tobacco warehouses has been undertaken mainly to ascertain to what extent infested tobacco still arrives in this country and to what extent certain warehouses in London are infested by the moth *Ephestia elutella*. With regard to the first question it has been shown that where infestation is high in the packing-sheds of the producing country correspondingly high infestation is shown in the tobacco on arrival in London. This tallies remarkably with results obtained two years ago in investigating dried fruit problems and almost warrants the assumption that there is a direct correlation between infestation in the producing country and infestation on arrival at the home ports.

In sampling tobacco arriving in London to determine the amount of infestation it was found that certain tobaccos affording distinct evidence of having living *Ephestia* larvæ. This confirms our opinion that in the United States of America, and probably elsewhere also, the dosages given during fumigation do not allow sufficiently for such causes of reduced concentration as leakage, absorption and poor penetration. It is evident that dosages of 16 ounces of hydrocyanic acid per 1,000 cubic feet of space are far too low for efficient fumigation of tobacco and that 24 to 30 ounces may be necessary.

In dealing with tobacco as with dried fruit the study of infestation of warehouses has received special attention, and it may be useful to explain why this is important. Infestation occurs in the producing country, during transport and during storage in the importing country. Even if the first two types of infestation were dealt with commodities imported infested warehouses would still run the very real risk of infestation during storage there. At the same time it is evident that methods for the control of insects in the warehouses in the home country will with slight modification apply to infestation during transit and infestation in the producing country.

Annual Report of the Branch of Plant Pathology

FOR THE YEAR ENDING 31st DECEMBER, 1934.

By J. C. F. HOPKINS, D.Sc. (Lond.), A.I.C.T.A.,
Senior Plant Pathologist.

GENERAL.

The wider interest shown by farmers last year in the use of fungicides has again been evident, and possibly, as a result, a good number of new brands of seed disinfectants, spray materials and pumps have appeared upon the local market. Local agents of fungicide manufacturers are of much assistance in introducing modern methods of disease control to the outside districts, but it is to be regretted that much of the effort devoted to propaganda on these lines is vitiated by the not-too-ready response of local merchants in stocking the required material and appliances. So much so that the farming industry was faced during November and December with the unique situation of not being able to obtain fine spraying nozzles anywhere in the Colony nor suitable pumps anywhere in South Africa, despite the fact that this Branch has been recommending field spraying of tobacco since the beginning of the year.

ROUTINE.

Three hundred specimens were sent in for report and advice, from which 35 diseases were newly recorded in the Colony. About one-third of the material received was tobacco, the remainder including maize, wheat and other cereals, deciduous and soft fruits, citrus, timber trees, and a variety of vegetables and miscellaneous plants, among which were a small number of the indigenous flora. One hundred and eighty specimens were added to the herbarium.

Examination for disease and germination tests were carried out on samples of seed submitted by the Agricultural branch and by seed merchants in Salisbury. Some time was

spent on the examination of rotted railway sleepers for the Forestry Branch, whilst the bulking up and maintaining of cultures of legume nodule bacteria was continued for the Manager, Salisbury Experiment Station.

Several reports were made on citrus material suspected of harbouring Canker, submitted by the Director of Agriculture, Beira.

In connection with duties on the Plant Regulatory Board, meetings were attended and inspections made of imported material and local nurseries.

At the request of the Chief Entomologist, examination was made of diseased locusts, and the locust fungus, *Empusa grylli*, definitely determined for the first time. (Fig. 1.) The diagnosis was confirmed by successful infection of healthy locusts under controlled conditions in the laboratory.

A number of determinations of rusts and other fungoid diseases of grasses was made at the request of Messrs. African Explosives & Industries, Ltd. in connection with their pasture experiments.

A list of new records of diseases has been communicated to the International Institute of Agriculture for publication in the *International Bulletin of Plant Protection*, but the annual supplement to the "List of Plant Diseases Recorded in Southern Rhodesia," which usually appears in the *Rhodesia Agricultural Journal*, has been withheld pending the determination of a collection of rusts and smuts of grasses which has been made from material in the botanical herbarium.

New Records of interest include:—White blister of Barberton daisy and Portulacca (*Cystopus cubicus* and *Albugo portulacæ*), leaf spot of parsley (*Septoria petroselinæ*), anthracnose of rose (*Sphaceloma rosarum*), pod rot of groundnut (*Rhizopus nigricans*), rust of broad beans (*Uromyces fabæ*), sore shin of antirrhinums (*Rhizoctonia solani*), stem-end rot (*Diaporthe citri*), brown rot (*Phytophthora citrophthora*), fruit rot (*Trichoderma lignorum*), stem-end and centre rot (*Alternaria citri* Bensch.) of oranges, veinbanding (*Virus*), storage mould (*Aspergillus sulphureus*), barn spot (*Aspergillus flavus*), and stem rot (*Rhizoctonia solani*) of tobacco.

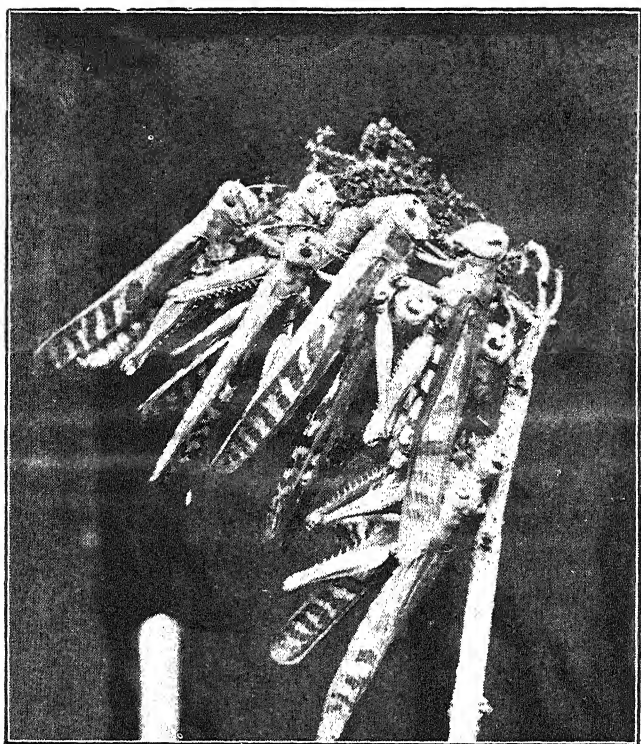


Fig. 1. Locusts infected by *Empusa grylli*. Typical cluster on tree.

MOVEMENTS.

Seventeen visits were made to the Tobacco Research Station, Salisbury, in connection with experimental work and seven to the new Tobacco Research Station, Trelawney, to supervise development. Calls were made at 66 farms in the Salisbury, Macheke, Umvukwes, Banket, Shamva, Mazoe Valley and Mtepetepa districts.

Two days were spent in conducting a party of British farmers on their official tour.

PUBLICATIONS.

A list of new records of diseases has recently appeared in the *International Bulletin of Plant Protection*.

A letter to the Editor of *Nature* recording successful infection of citrus seedlings by *Rhizoctonia lamellifera* was published in November.

"Mycological Notes—Spraying Tobacco in Seed-beds and Lands" appeared in the October issue of the *Rhodesia Agricultural Journal*.

A memorandum on research on the locust fungus (*Empusa grylli*) was published in the official report of the Imperial Locust Conference held in London in September, 1934.

A paper on "Co-ordination of Mycological Research in the Empire" was read at the Third Imperial Mycological Conference held recently in London.

RESEARCH.

Little time has been available this year for research owing to the demands of administrative and advisory work, particularly since the appointment of the Senior Plant Pathologist to take charge of the new Tobacco Research Station at Trelawney. The following investigations have, however, been carried out.

Tobacco.—Examination of a number of suspected virus diseases of solanaceous plants has shown that symptoms similar to those described as being due to viruses may be caused by a number of external agencies.

Transmission of disease by juice inoculation and grafting was unsuccessful in the cases of suspected spotted wilt and "Kromnek," the latter affection being almost certainly due

to lightning damage. It is most noteworthy that the symptoms, presumably produced by lightning (Fig. 4) should be closely akin to those described by Dr. Moore⁽¹⁾ for "Kromnek" in tobacco. A comprehensive inoculation experiment failed to establish the presence of a virus.

The first record of "veinbanding" in Rhodesia was made during the year. Inoculation of filtered juice to healthy tobacco plants produced 100 per cent. ordinary mosaic. This result was confirmed by Dr. K. M. Smith, at Cambridge, who kindly tested the "veinbanding" material in his laboratory. It is suspected that the virus may have been transferred to tobacco from a neighbouring potato crop by means of aphids.

Beans.—Following upon last year's attempt at obtaining French bean seed free from the bacterial blight organism, a collection has been made of 8 so-called blight resistant local varieties. Two samples of seed of "Fettfleckenkrankheit"-resistant strains have been kindly supplied by Dr. Stapp, of Berlin. These seeds have been planted in blight-infected soil for trial.

Rhizoctonia Root Disease.—Continuing the work of the past eight years, further attempts have been made, as far as time will allow, to study the parasitism of *Rhizoctonia tammellifera* on citrus seedlings growing in soil. No high percentage of infection has as yet been obtained under more or less normal conditions of temperature and humidity, but relatively rapid infection has been noted when environmental conditions are abnormal.

Field Experiments.—Further field spraying experiments on a larger scale than heretofore were carried out with tobacco at the Research Station, Salisbury. Three types of fungicide were employed and the plots inoculated with pure suspensions of angular spot and wildfire bacteria. Various combinations of spraying and priming were used. Unfortunately, weather conditions were not favourable to the spread of bacterial diseases and no significant effect of the spraying could be

(¹) Moore, E. S., "The Kromnek or Kat River Disease of Tobacco and Tomato in the East Province (South Africa)." Union of S. Africa, Dept. of Agric., Science Bull. 123. 1933.

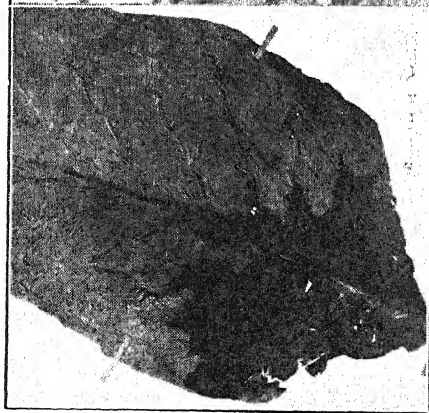


Fig. 2.—Barn rot of tobacco. Herbarium specimen.

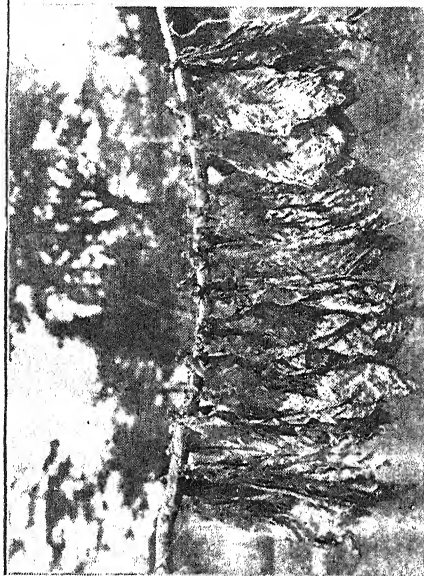


Fig. 3.—A stick of cured tobacco badly affected by barn rot.

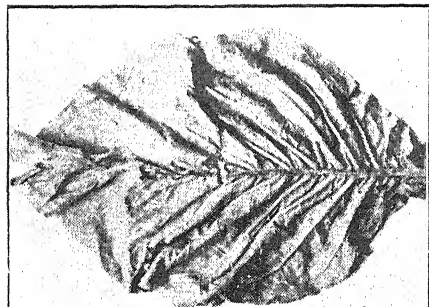


Fig. 4.—Leaf symptoms corresponding with those of "Krommek" of tobacco, but believed to be caused by lightning. Note contracted and shrivelled midrib. The leaf tip was curled in towards the stem before removal from plant.

detected. Useful information was, however, obtained regarding the quantities of spray fluid used, acreage per day covered by one pump and the cost of operations.

Complete control of all diseases in the seed-beds was again obtained by all three fungicides tested.

CROPS.

Tobacco.—From the point of view of prevalence of diseases, the 1933-34 season must be regarded as somewhat misleading. The early reapings produced some of the best quality and cleanest tobacco ever grown in the Colony, but the marked freedom from spotting of this part of the crop was counter-balanced by the large amount of perished grades received towards the end of the season. The principal causes of deterioration of the later crop were frog eye, both field and barn spot, and barn rot (*Rhizopus stolonifer*); there was a noteworthy diminution in the amount of bacterial diseases.

To examine the factors responsible for the sudden drop in grades, it is necessary to consider the methods of handling the crop which were employed, and the meteorological records. Very favourable climatic conditions occurred throughout the Colony, so that the tobacco grew to an abnormally large size very rapidly. In most cases the amount of leaf being carried in the lands was far in excess of barn accommodation, so that when reaping commenced, barns were packed so excessively closely that ventilation was inhibited, and the air remained saturated. Barn rot (Figs. 2 and 3) very soon developed under these conditions, and, where frog eye was present, severe black barn spotting also appeared. The situation became much worse later in the season when some late rain fell in most districts. Frog eye became rampant in the fields on leaf which should have been primed off weeks before, and black barn spot increased, so that a large proportion of the late crop, which should have been leaf of excellent quality, was rendered almost unsaleable.

There is no doubt that the influx of so much low grade leaf on the local market had a depressing effect on prices, so that once more the necessity for farmers to grow for quality rather than quantity is emphasised. It cannot be too strongly urged that more attention be given to disease control, espe-

cially where frog eye is involved, and growers must learn to adjust their priming to meet the requirements of frog eye control. In this connection a true plant pathological service, which would include travelling advisers to direct disease control operations, is most essential if a crop of good quality leaf is to be produced year by year. Advice given at the right moment might easily save the industry an annual loss in the neighbourhood of 10 per cent. of the crop, or approximately £100,000.

An outbreak of leaf curl in the Shamva district was closely investigated with the assistance of the Tobacco Pest Inspector. The origin was traced to ratoon plants on an abandoned farm, where white flies were breeding in profusion. The removal of the source of infection and replanting of infected lands did much to ameliorate the position, but heavy losses were experienced on the affected farms. This instance serves once more to illustrate the danger of neglecting disease control. It is the duty of every farmer to protect himself and his neighbours, so that any tobacco stalks left standing or not uprooted by August 1st should be immediately reported to the local police.

A new type of barn spot during curing has been shown to be due to *Aspergillus flavus*.

Maize.—Increased interest has been noted in the use of seed dressings against seed-borne diseases, and it is hoped that seed treatment will become a routine duty in the near future. It has also been observed that more attention is being paid to cleaning up old maize stalks at the end of the season.

Early in the year a suspected outbreak of "streak" disease was reported on one farm in the Mazoe Valley. Material was sent to Dr. Storey, at Amani, who stated that the disease was not due to the "streak" virus, and kindly sent authentic specimens of that disease.

Potatoes.—Black scurf (*Corticium solani*) is very widely distributed. It does not, as a rule, cause serious injury to crops, but occasionally severe reduction in stand can be attributed to this disease. Most potato growers do not appear to be aware of the symptoms of black scurf, for sclerotia of the

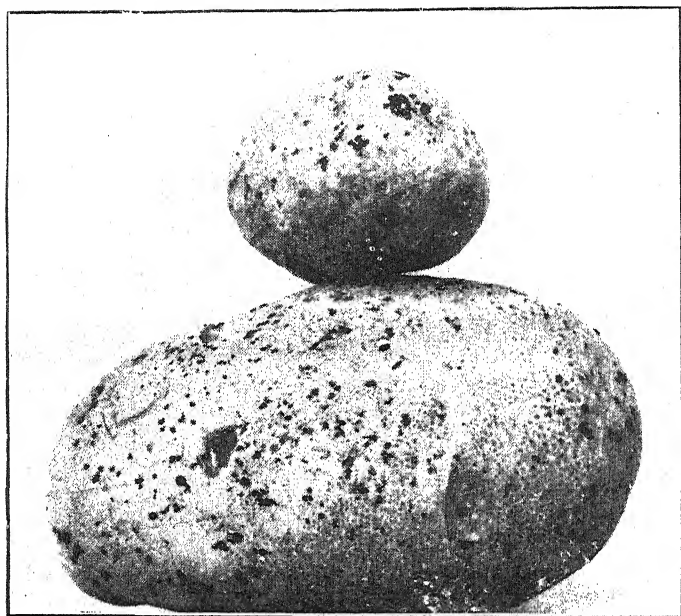


Fig. 5. Black scurf of potato. Note black sclerotia of infecting fungus which look like particles of soil.

fungus may usually be seen, in greater or less profusion, on seed potatoes exhibited at Agricultural Shows. (Fig. 5.) It is not uncommon for such infected samples to receive first prize.

Common scab continues to cause damage on some farms, but it is not generally severe.

Wheat.—The abnormally warm winter has apparently been responsible for an epidemic of rust which is reported to have reduced the crop of the Colony by one half. In actual cases examined, whole crops have been completely destroyed. This catastrophe emphasises the need for testing resistant varieties under as wide a range of conditions as possible, and also suggests that an investigation of physiologic forms of the rust fungi should not be delayed.

Deciduous and Soft Fruits.—Progress has been made in the control of apple mildew by growers in the Eastern districts. Last year a tentative pruning and spraying schedule was drawn up and, where applied, has produced beneficial results. Trials have been made with various brands of sulphur dusts, but so far lime-sulphur sprays have proved to be the most satisfactory.

Strawberry mildew continues to prove difficult of control. Tests with different kinds of sulphur dust have been disappointing, the best control being obtained with 10 per cent. copper-lime dust. There is room for considerable improvement in the elimination of this disease, but the conditions in the Eastern districts are so different from those in Salisbury that local problems need investigating "on the spot."

No routine control has yet been evolved for the root rot of strawberry, suspected to be black root rot.

Mildew of grapes was again serious and much damage was done. This disease may be adequately controlled by suitable spraying and dusting with sulphur, but the average owner of a vine is content to see his fruit rot away and attribute his losses to rain.

Miscellaneous Plants.—Foot rot of garden flowers, particularly godetia, clarkia, antirrhinum and delphinium, due to strains of *Phytophthora parastica*, have been found to be

amenable to control. Cheshunt Compound has given good results, but as this substance is difficult to obtain locally tests have been made with Bordeaux Mixture as a substitute. A small amount of the ready-made powder forked into the soil round each plant has proved most satisfactory and has been adopted by some commercial growers.

White blister of Barberton daisy, due to the fungus *Cystopus cubicus*, has been troublesome, but can be controlled by suitable spraying with Bordeaux Mixture in the early stages, combined with removal and destruction of infected leaves.

Anthraxnose of rose (*Sphaceloma rosarum*) is common, causing considerable disfigurement of bushes. Black spot (*Diplocarpon rosae*) and mildew (*Sphaerotheca pannosa*) continue to do damage, the latter disease being serious on many susceptible varieties. All three diseases (Figs. 6, 7 and 8) may be controlled by spraying with lime-sulphur or suitable sulphur dusts, but mildew requires special attention for spraying to be successful.

Root rot (*Sclerotium rolfsii*) and mildew (*Erysiphe polygoni*) (Figs. 10 and 11) of delphinium have caused losses particularly where plants have been grown in the shade of trees or in other damp places. Watering round the plants instead of from above and general improvement of soil drainage have given good results in the control of these diseases, but dusting with sulphur has not been attended with much success.

Probably as a result of continuous rains early in the season, carnation leaf spot (*Septoria dianthi*) (Fig. 9) has been more prevalent than usual. Although not as a rule of economic importance, the disease has this year attacked the calyx, causing splitting and disfigurement of commercially grown flowers.

STAFF.

Dr. G. M. Wickens, Ph.D., D.I.C., was appointed as Assistant Plant Pathologist, and took up his duties in this laboratory early in December.

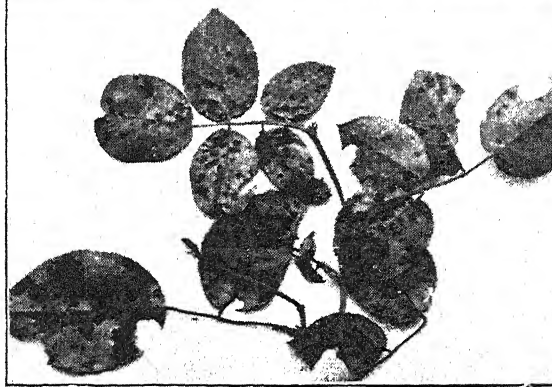


Fig. 6.—Black spot of rose.

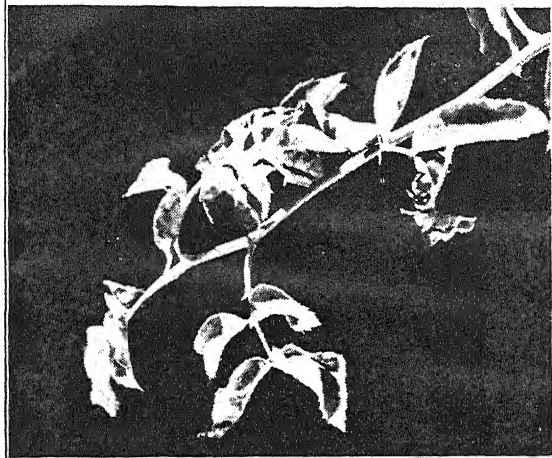


Fig. 7.—Mildew of rose on newly-formed shoot.

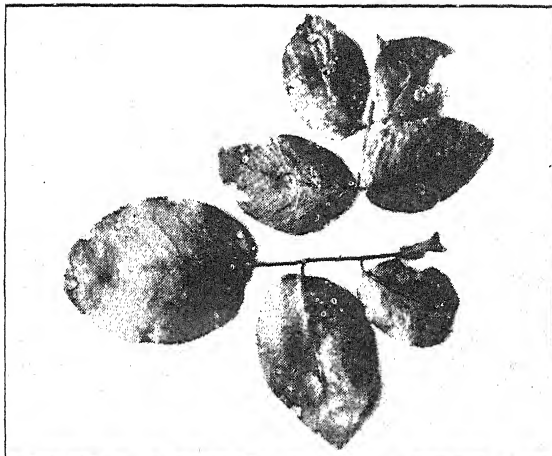


Fig. 8.—Anthracnose of rose.

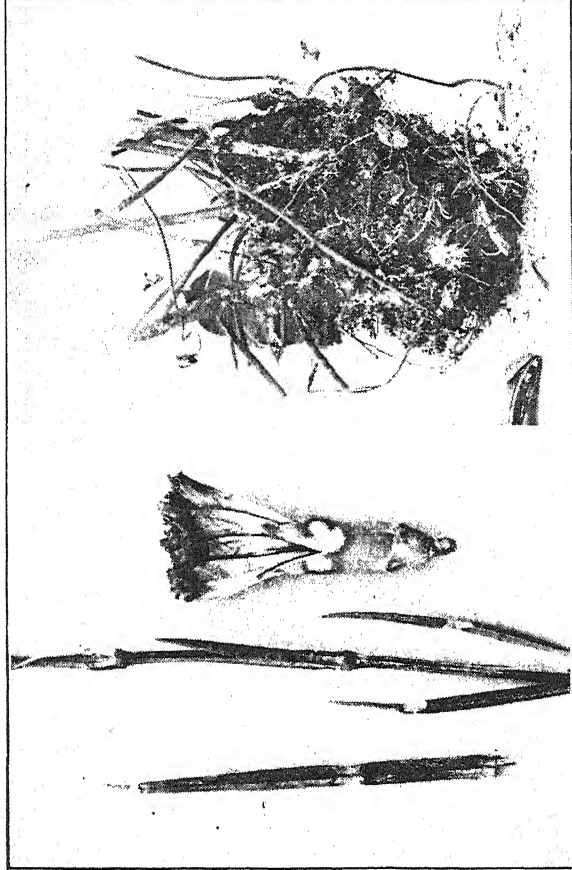


Fig. 9.—Leaf Spot of carnation.

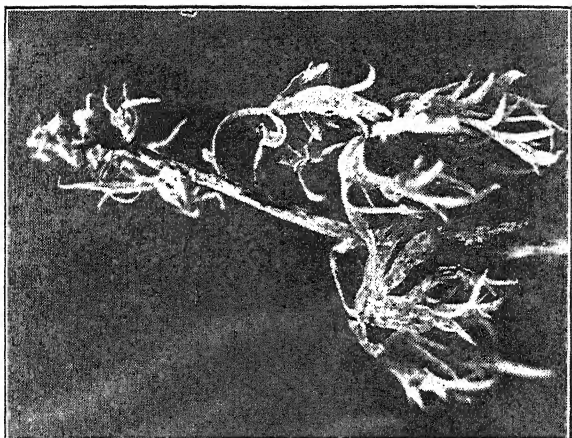


Fig. 10.—Root rot of diphenium. Note white strands of fungus in soil and on roots.

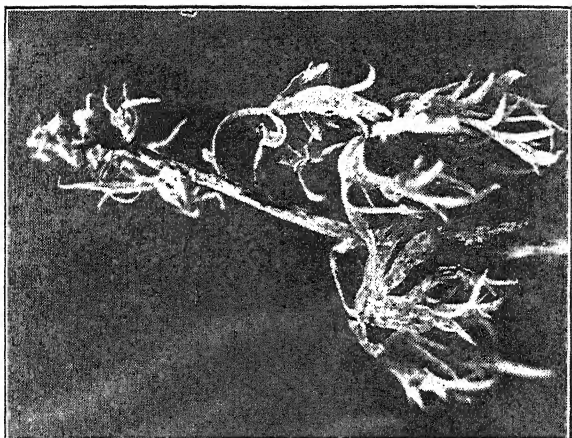


Fig. 11.—Advanced stage of mildew on delphinium. The blackening of leaves is due to the production of winter spores by the fungus.

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I was appointed Senior Plant Pathologist in charge of tobacco research at the new Tobacco Research Station, Trelawney, and assumed office in August.

MISCELLANEOUS.

In connection with my paper on "The Co-ordination of Mycological Research in the Empire," read at the Imperial Mycological Conference, a scheme for co-operative mycological research, between various universities and colleges in the Union, Britain and the West Indies has been submitted to the Government and the views of the institutions concerned obtained.

The usual exhibit was prepared for the Salisbury Agricultural Show.

My thanks are due to the Director, Imperial Mycological Institute, and several of my colleagues for assistance in identification and advice on methods of control.

A Cheap Levelling Device.

By A. W. LAURIE, Howick Vale, Concession.

The following description of a cheap form of levelling device should be of interest to those farmers who desire to set out ridge terraces, storm drains, etc., themselves, but who are debarred from doing so on account of the expense of scientifically manufactured levelling devices.

The device described below has been found very satisfactory in practice, provided care is used in working with it.

Material Required.—One builders' line level (approximately cost 3s.).

Approximately 110 feet of cord, such as coarse fishing line.

Two deal staves of about 4-inch by 1-inch timber, one about 3 feet long and the *other exactly 2 feet longer than this one*; each staff is fitted with a foot-piece about 4 inches by 4 inches by one inch thick.

Construction.—Figure 1 shows the construction of the staves.

(a) The shorter, 3 feet staff, is prepared for use merely by setting a small projecting screw on the top.

(b) The longer, 5 feet staff, has a similar screw set on the top, but in addition has a number of cup-hooks or eyed screws set at varying intervals down the edge, these hooks being placed at specific distances from the top of the staff, depending on the grades of the ridge terraces or storm drains, etc., being set out.

The following are the distances at which hooks are placed for setting out various grades:—

Grade.	Distance of hook from top of staff.		
1 in 50... ..	Screw at top of staff.		
1 in 100... ..	Hook 12 inches below top.		
1 in 150... ..	„ 16	„	„
1 in 200... ..	„ 18	„	„
1 in 300... ..	„ 20	„	„
1 in 400... ..	„ 21	„	„
1 in 500... ..	„ 21 $\frac{3}{5}$	„	„
Level	„ 24	„	„

Method of Use (See Fig. II.).—Fix one end of the cord to the top screw of the *smaller* staff and the other end to a screw or hook on the larger staff, the screw or hook selected being the one appropriate to the grade being used; the cord must be of such a length that the staves can be set out exactly 100 feet apart.

The builders' line level is then fixed at the exact centre of the cord so that it is exactly 50 feet from each staff when they are drawn apart.

The staves are held up right *resting* on the ground and 100 feet from each other, one staff being placed at the point from which levels are to be set out and the other being moved uphill or downhill until the bubble of the level is in the centre of its run.

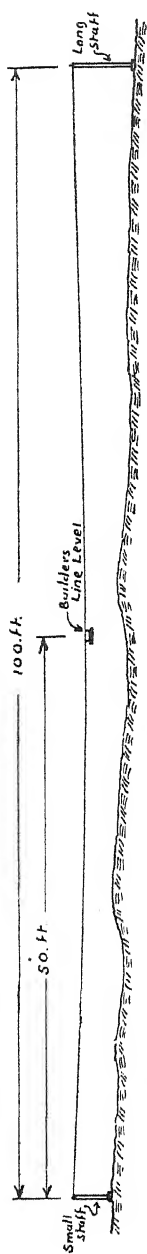
If a downhill grade is being set out, as is usual, the shorter staff must always be the fixed one.

If an uphill grade is to be set out, the longer staff will be the fixed one.

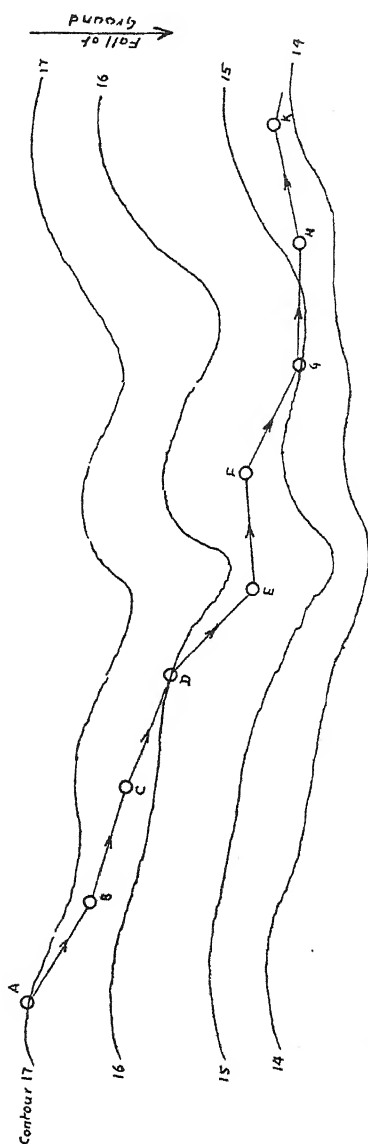
Setting Out a Grade Line.—If it is desired, as an example, to set out a downhill grade of 1 in 300 from a point "A" (see Fig. III.) the following is the procedure:—

(a) Fix the end of the line to the hook on the longer staff corresponding to a grade of 1 in 300, that is to the hook 20 inches below the top of the staff.

(b) Place the shorter staff at "A"; stretch out the line and place the longer staff at a distance of 100 feet from the smaller staff, and in the general direction which the grade line will follow.



—FIG. II.—



—FIG. III.—

(c) Move the longer staff uphill or downhill until the bubble on the level is in the centre of its run.

(d) When the longer staff is in such a position that the bubble of the level is central, mark the point where the longer staff rests; this is point "B."

(e) Now move the shorter staff to "B" and again proceed as described above to find a point "C" on the grade line and continue on similarly.

Should it be desired to set out an uphill grade from a point, carry on as above, *but place the longer staff each time at the last fixed point* and move the shorter staff up or down to find the new point.

Points to Note.—(1) Always keep the staves 100 feet apart and the level exactly half way between the staves.

(2) When a new point is being found, see that the staff being moved is placed on the ordinary ground surface, and not on lumps or stones, or in hollows or holes.

(3) The grade line is actually correct only *at* the points found and any ridge or drain must be properly graded between these points. If a hollow is being crossed between points, the ridge or drain must run above the straight line between the points, or else be banked up well; if a rise is traversed between points, the ridge or drain must run below the straight lines between the points or must otherwise be excavated deeper.

(4) It is advisable to mark against each hook on the longer staff the grade to which the hook applies.

(5) See that the thickness of each foot piece is included in the length of the staves when making them and take care that the foot piece are always fixed to *both* staves. If one piece is lost the grade line will not be correctly set out.

Annual Report of the Division of Irrigation

FOR THE YEAR ENDING 31st DECEMBER, 1934.

By P. H. HAVILAND, B.Sc. (Eng.), Chief Irrigation Engineer.

The year under review has resulted in further marked increased demands for the services of the Division, but although the staff has made every effort to comply with the demand, it has not been possible to do so and over 40 applications have had to be left unattended to.

A similar position existed the previous year, but the outstandings at the end of that year were not quite as many as at the 31st December, 1934.

In addition to the number of visits unattended to, referred to above, a large number of requests were refused of which no note was made in this office.

There has been a very encouraging increase in the interest displayed by Matabeleland in the conservation of water, and the number of visits carried out in that part of the Colony was in excess of the number for 1933. It is hoped that this interest will be maintained and that it will result in the construction of water conservation works to a greater extent than is being done at present.

The number of visits carried out on soil conservation remained the same as in the previous year. This was the result of staff shortage.

With the formation of the Soil Conservation Advisory Councils there will be a very large increased demand for the services of the engineers in 1935, and it is hoped that the staff arrangements will be such as will enable the demand to be fully met.

In addition to the interest taken in water and soil conservation, a great deal of advice has been given on irrigation, and this matter is undoubtedly receiving the very careful attention of both the farmer and the rancher.

The following summary sets out the approximate expenditure controlled and administered by the Division during 1934, together with the estimated costs of further works investigated. It does not include, however, any estimate in connection with advisory work to farmers and ranchers.

Summary of Expenditure Controlled and Administered, etc.

General boring operations... ..	£6,375
Water supplies in Native Reserves—	
(a) Boring	£9,520
(b) Water conservation works	3,900
	13,420
Water supplies in Native Purchase Areas—	
(a) Boring	£420
(b) Water conservation works	505
	925
Water supplies, Government Institutions	2,560
Water supplies, Townships	1,552
Meteorology and Hydrography	1,100
Soil conservation investigations... ..	140
Irrigation Loan Funds, Loans granted	1,248
Agricultural buildings erected	1,380
Total	£28,700
Applications for loans reported on, granted by	
Land Bank	£272
Estimated costs of water supplies, Government	
Institutions, surveyed and reported on, but	
not constructed	11,265

General.—The summary below sets out the number of visits paid by officers of the Division in connection with irrigation, soil conservation, water conservation, etc., but no provision is made for visits performed in this connection by either the Boring Superintendent or the Boring Engineer, although these two officials have aided very considerably in this matter, the Boring Inspector alone having visited some 38 farms in connection with the provision of water supplies, and in addition 9 Native Reserves to inspect the construction of water conservation works.

Summary of Visits.

Visits to private applicants on irrigation and water conservation	109
Visits to private applicants on soil conservation	156
Visits to Native Reserves, etc., Townships and Government Institutions	93
Farmers' Associations, meetings attended	6
Road Boards attended	1
Miscellaneous visits	29
Total	394

Under the item "Miscellaneous Visits" are included several visits to report on applications before the Water Court, but the majority of such visits were performed by the Hydrographic Engineer (Meteorologist) and are not included in the summary.

The following shows the visits performed by the Division for the last three years:—

1932	289 visits.
1933	358 visits.
1934	394 visits.

Further details of the work performed are given under the separate headings.

Irrigation and Water Conservation.—Only minor irrigation schemes, other than those in Native Reserves, have been favourably advised on during the year, but one farmer near to Salisbury has commenced the construction of an earthen dam, which, when completed, will enable a large acreage to be placed under irrigation. Altogether nine small irrigation schemes were favourably reported on, the acreage irrigable being 180 acres. These figures do not include any schemes visited only by a Water Court.

Increased interest is, however, being taken in irrigation and a number of visits in this connection have already been applied for, and will be carried out in 1935.

Statistics for the year under review are not available yet, but the 1933 figures show a total area of 20,867 acres under

winter crops. This figure is an increase of about 15½% over the figures for 1932. The Statistician's forecast, as at September, of the crop returns for 1934, indicated that the irrigated areas for 1934 will be approximately the same as in 1933.

The following are the figures of wheat production for 1933:—

	Acreage.	Yield (bags)	Bags per acre.
Irrigated wheat	6,430	21,514	3.3
Non-irrigated wheat	10,245	13,961	1.4

The areas under wheat for 1933 have increased by about 18½% in excess of the areas for 1932, but the yields in bags per acre have decreased very considerably, the figures for 1932 being 4.5 and 2.2 bags respectively.

It is probable that this decrease was due to locusts and frost, but it is very noticeable that the decrease in yield is much greater as regards non-irrigated wheat than in the case of irrigated wheat. It would appear therefore that special encouragement should be given to the growing of wheat under irrigation in preference to its production on wet "vleis."

As stated previously very much more interest is being taken in water conservation, particularly in Matabeleland, where a number of visits were paid on advice in this connection. Further encouragement is, however, required, and it is considered that in addition to providing money for loans on easy terms, the construction of minor conservation works in selected areas should be undertaken partly or wholly by the Government, in order that the direct results of conservation may be made apparent to the individual rancher and farmer.

Although such work is being undertaken by the Government in Native Areas, this is seen by very few persons, whereas similar work in European-owned areas would effect a very useful and concrete form of propaganda.

The Malemi storm water canal, which feeds the Matopo Dam, was surveyed in detail with a view to determining how the régime could be improved. As a result of these investigations, certain repairs were effected which it is hoped will, together with further work to be put in hand in 1935, effect the desired improvement.

Soil Conservation.—A great step forward has been taken during the year in this connection by the appointment of two Soil Conservation Advisory Councils, one in Mashonaland and one in Matabeleland. The Councils were appointed as a result of the Rhodesian Agricultural Union's Sub-Committee's Report on Soil Erosion, and have already commenced to function.

Each Council has met and sub-committees have been formed to deal with various aspects of Soil Conservation, and it is gratifying to note that very marked interest in the subject is displayed by all individual members.

As a result of the appointment of the Councils it is certain that work on soil conservation will increase very considerably during the next and future years, and the general public will have the matter brought more to its notice than has been possible in the past.

The Soil Conservation Station, at Glenara Farm (Messrs. Newmarch and MacLean), was completed too late to enable any data to be collected during the rains at the beginning of the year, but some very interesting data have been obtained during the present rainy season.

It is hoped that a second station will be established on a sand-veld area during the next year, as there is very little knowledge on erosion on this type of soil.

The Matabeleland circle performed 11 visits on soil conservation during the year, and that portion of the Colony is slowly commencing to realise the importance of adequately dealing with erosion.

Soil conservation must go hand in hand with water conservation, and it is hoped that further propaganda will enable the farmer and rancher to realise this.

The total area of land protected this year, as a result of visits by officers of the Division, amounts to 3,780 acres; ridge terracing to the extent of 126 miles was constructed, and storm drains to the length of 25 miles dug.

The following summary sets out the length of ridge terracing constructed and the areas of land protected annually, since 1929, as a direct result of the work of this Division.

Year.	Miles of Ridge Terracing.	Acres of Land Protected.
1929	76	2,280
1930	103	3,090
1931	150	4,500
1932	108	3,240
1933	132	3,960
1934	126	3,780
Total	695 miles	20,850 acres

The reason for the smaller length of ridge terracing pegged this year as compared with 1933, was due solely to staff shortage, necessitating a smaller amount of time being spent on visits to individual farms.

It is of interest to note that a farmer near Gatooma has just written to request the services of an engineer to peg out ridge terraces on his land, which he states he has only just realised is being badly eroded; he states that he has some 700 acres to protect.

Up to date very little soil conservation work has been carried out in that district, but this will probably be the forerunner to a large number of requests for visits in the future.

Loans.—In all, some twenty applications for loans for water and soil conservation and irrigation were received. Of these three were refused and four, amounting to £272, granted by the Land and Agricultural Bank of Southern Rhodesia.

The thirteen loans approved and met from Loan Funds controlled by this Division, amounted in total to £1,248, of which £560 was approved for irrigation proper and the remainder for water conservation, well sinking, pumping plants, and one loan of £18 for soil conservation.

Water Conservation and Irrigation in Native Areas.—

The policy of constructing water conservation works in Native Reserves and Purchase Areas was continued during the year and further work in this connection was carried out in the Nata, Gwaai, Insiza, Raditladis, Gwanda, Semokwe, Shangani and Wankie Reserves and in the Chilimanzi Native Purchase Areas.

In all five concrete weirs and six earthen dams have been completed during the year, and a further two weirs are in the course of construction, the work on the latter having been delayed to some extent by weather conditions. In addition investigations have been made of further possible conservation sites in most of the above mentioned areas, and in other areas. Special reconnaissance surveys were carried out in the Maranke Reserve and the Msengesi Native Purchase Area; in the former five suitable sites for storing water were found and in the latter three suitable sites were discovered.

In the Nata Reserve two earthen dams were built on the Godza and Umbuzana Rivers, the respective storages being $1\frac{1}{4}$ and $2\frac{1}{2}$ million gallons; these dams store water to maximum depths of 9 and $7\frac{1}{2}$ feet respectively. Both dams were fenced and pre-cast concrete drinking troughs provided. In addition the Longwe Pan was deepened.

A concrete weir to store $1\frac{3}{4}$ million gallons, with a maximum depth of $7\frac{1}{2}$ feet, was constructed in the Gwaai Reserve, on the Umguzana River; this weir was provided with a concrete trough, constructed parallel to the weir, the downstream face of the weir forming one side of the trough. The existing weir on the Gwaai River, near Tjolutjo, was provided with a further length of draw-off piping extending some 300 feet upstream of the weir; this was done in order to enable water stored above a small rock outcrop to be drawn off; the conservation basin of this weir has completely filled up, the upper 30 inches of the filling consisting of a very fine clayey silt; it is hoped that part of this silt may be removed by heavy floods during the present rainy season.

In the Insiza Reserve, an earthen dam was constructed to store water to a maximum depth of 10 feet, the total storage capacity being $3\frac{1}{2}$ million gallons; this dam was fenced and provided with a concrete trough.

An earthen dam was built in the Raditladis Reserve, to store 10 million gallons to a maximum depth of 8 feet; a concrete spillway almost 150 feet in length was found to be essential, and this added considerably to the cost.

Contracts were let for the construction of four concrete weirs in the Gwanda Reserve, and up to date two have been constructed, while the other two are in the course of con-

struction; it is hoped to complete the two latter before the end of the rains, but weather conditions make the work difficult: three of these weirs are situated on the Pelele River and one on the Nsangwa River. The storages vary from 2 million gallons to $3\frac{1}{2}$ million and the maximum depth of the storage from 8 feet to 9 feet.

In the Semokwe Reserve a concrete weir has been constructed on the Mabonyane River: this conserves some $4\frac{1}{2}$ million gallons, the maximum depth of storage being 7 feet.

In the Shangani Reserve a small earthen dam was built.

In the Wankie Reserve the construction of a small earthen dam was completed: this stores water to a depth of 8 feet and is primarily intended to supply water for the Sialwindi dip.

A concrete weir, with one earthen flank, was constructed in the Chilimanzi Native Purchase Area, the maximum depth of storage being 8 feet; a trough, with a special compartment for domestic supply, was built abutting on and parallel with the downstream face of the weir.

A departure in design has been put into effect on the Gwanda Reserve weirs. These weirs are being constructed solid to a height of about six feet and above this level a series of openings, 5 feet wide and 2 feet high exist, these openings being covered by means of metal plates bolted to the concrete. This design has been decided on to permit the deposits behind the weir being scoured out to a depth of 2 feet, by removing the plates during heavy floods. The plates will probably only be removed should the storage basins fill up with fine silt.

In connection with the filling of the conservation basins with sand, no difficulties are experienced in drawing off water by the "French drain" system; but this method is not so satisfactory if the basins fill with fine clayey silt. If this fine silt is brought down, however, the scour opening just described may enable it to be scoured out sufficiently, but if this is not effective, the matter of a new design will have to be considered.

In addition to the work just described, investigations were carried out into a suggested irrigation scheme in the Maranke Reserve. The results of the survey proved the scheme to be impracticable.

Visits of inspection were performed and later reports submitted on existing and suggested new irrigation schemes in the Zimunya, Mutambara, Muwushu, Mutema and Musikavanthu Reserves, in all seven schemes or projected schemes being visited.

In addition an inspection was made of the extensions of the existing Mutema Reserve irrigation scheme, from the Tanganda River.

A suggested large 20,000 acres storage scheme to serve the Muwushu Reserve was found to be not possible.

In this connection it should be stated that further investigations as to the possibility of a large irrigation scheme in the Sabi Valley, for the irrigation of Native Reserves, would be justified, as it is possible that such a scheme might be found feasible on one of the many large tributaries on the left bank of the Sabi River.

The existing irrigation scheme in the Mutema Reserve is proving very successful, as is also the Nyachowa River scheme in the Zimunya Reserve.

It is probable that irrigation in Native areas will be extended very considerably in the future.

Township Water Supplies.—During the year investigations were carried out to determine the costs of a major water supply scheme to supply Plumtree Village, the School and all Government Institutions. A suitable site was found on the Tegwani River at a point some 6 miles distant from Plumtree. The estimated cost of the scheme is £10,000.

The Gwanda water supply has been proceeded with. Early in the year a weir, some 10 feet high, to conserve some 22 million gallons of water, was completed on the Mtshabezi River; the construction was rendered difficult by floods, but the work was satisfactorily carried out. Contracts for the supply of piping, engine, pump, etc., have been let, but the reticulation system has not yet been laid.

A preliminary investigation was carried out of a new water supply scheme for the Municipality of Que Que, and a report submitted to the Municipal Council.

Reports were also submitted on water supplies for Enkeldoorn, Hartley and Sinoia Villages.

Water Supply: Government Institutions.—New water supply schemes or additions to existing schemes were completed at Essexvale Police Camp, Matopo Estate, Hartley School and Native Commissioner's quarters and the Veterinary Research offices, etc., at Salisbury. In addition the Ndanga Hospital water supply was commenced and certain contracts let in connection with the new water supply scheme for the Mtoko Native Department, and minor work carried out at Chibi, Filabusi, Inyati and Enkeldoorn hospital.

Surveys and estimates of costs for other water supply schemes were also carried out.

Miscellaneous Visits.—These included attendance of members of the staff as technical witnesses before Water Courts and also inspections carried out for the Water Court, other than by the Hydrographic Engineer, but do not include attendance at Courts as official members. Under this heading are also included visits to Trelawney Tobacco Experiment Station to superintend the erection of buildings at that station, where living quarters for the staff, grading shed and tobacco barns are being erected; a great deal of this work has already been completed, all plans, etc., having been prepared in this office.

Boring.—During the year the same number of drilling machines were in use as in 1933, namely eleven, and the periods of operation of individual machines varied from 9½ months to 12 months.

Work was carried out to a total extent of 127½ drill months. Only one borehole was drilled on a mining property, but the number of boreholes sunk gave an increase of 18 over the number for the previous year.

Sixty boreholes were drilled for private applicants compared with a total of fifty-three for 1933.

The following summary sets out footage drilled, number of boreholes sunk and average costs.

	Applicants. Private	Govt. Institu- tions.	Native Purchase Areas.	Native Reserves.	Totals etc.
Total depth drilled at full cost or full tariff rates ...	4,729 ft.	716 ft.	200 ft.	8,864 ft.	17,150 ft.
Total depth drilled on which rebates have been granted	2,641 ft.	—	—	—	
Number of drill-months occupied	53½	8	3	63	127½
Footage drilled per working month per drill	137.7 ft.	89.5 ft.	66.6 ft.	140.7 ft.	134.5 ft.
Number of boreholes sunk...	60	5	3	76	144
Average depth of boreholes	123 ft.	143 ft.	66 ft.	117 ft.	119 ft.
Average cost per foot at full cost or full tariff rate ...	18/2d.	28/3d.	40/8d.	19/9.4d.	19/8.6d.
Average cost per foot drilled allowing for rebates	7/11d.	—	—	—	7/11d.
Average cost per foot drilled at full tariff rates and allowing for rebates... ..	14/5.9d.	—	—	—	14/5.9d.
Percentage of successful boreholes... ..	56.6%	40%	33.33%	78.94%	67.36%

Boring for private applicants during the year has resulted in an increased cost as compared with 1933 of 2s. 7d. per foot drilled, where full charges have been paid, but this increase, without explanation, would lead to an erroneous conception. The increase is due to the large number of boreholes which were drilled in the bottom of existing wells; in cases such as this the greater part of the cost is incurred in dismantling pump, windmill, etc., timbering the well tops and cementing in the casing, all of which is necessary before actual boring can be commenced: the total costs to the applicants, however is, in the majority of cases, much less than would be incurred by sinking new boreholes next to the wells.

With the exception of the new policy of granting rebates of the charges incurred in sinking unsuccessful boreholes, exact comparison cannot fairly be made between costs incurred by private applicants in past years and the costs incurred to-day.

If consideration is had to the rebates which have been granted, the total average cost to private applicants is found to have been reduced by 1s. per foot, which is a very satisfactory position.

The only disturbing feature in connection with this matter has been the decrease in the percentage of successful boreholes: this percentage is 56.6% as compared with a figures of 78% for last year.

The failures have occurred chiefly in the granite areas where boring or well sinking has always been a speculative proposition. The short rainfall of the past three years is without doubt one of the chief causes of the unsuccessful boring, as the upper fractured and partially decomposed zones in the granite are now in a markedly drier condition than they have been for many years; this is evidenced in the drying up of shallow wells; the general impervious nature of the granite in the lower zones does not lend itself to the storage of water which can later be tapped by boreholes, but in this connection the Boring Superintendent makes the following remarks:—

“It is quite probable at depth in the granites, fissures may exist of which there are no surface indications, and if such fissural zones can be located by geophysical prospecting, the results will be most valuable.”

Water divining has been of no value, and it is considered quite useless to adopt such a method of determining the presence or otherwise of water, while the lack of knowledge on the subject is so profound.

Boring at Government institutions this year has also proved a costly undertaking, the cost per foot drilled being 28s. 3d. as compared with a cost of 23s. 1d. in 1933. Three failures in this connection occurred in granite country, where four boreholes were put down. One of these boreholes was drilled in the granite to a depth of 221 feet, as an experimental hole at the Trelawney Tobacco Research Station; it is hoped to be able to investigate sub-surface conditions to a depth of about 600 feet by geophysical methods, and if, as a result, the indications of obtaining water at depth are good, it is considered that this borehole should be deepened.

Costs of work in the Native Purchase Areas appear high, but these apparently high costs were due to loss of drilling time and heavy transport charges incurred in moving the drilling machine from Bulawayo to the Mshagashi Division, in the Victoria District. This machine has now been moved to the Jenya Division, where work is in hand.

The work in the Native Reserves during the year under review has, on the whole, been very satisfactory in spite of an increase in the cost of drilling of 1s. 10d. per foot. This increase is accounted for by the long move of Drill No. 10 from Salisbury to the Nata Reserve, and again by the long move of Drill No. 8 from the Kkoto Reserve to the Mtoko Reserve; in addition the increased costs are due to the drought conditions in Matabeleland, which resulted in the necessity of purchasing grain and hay for the transport oxen.

There has, however, been a most satisfactory rise, from 59% to 78.94%, in the percentage of successful boreholes, and this in spite of the fact that in the Insiza and Belingwe Reserves all boreholes, six in number, were failures.

Work had to be stopped in the Belingwe Reserve at the end of October, owing to lack of water for drilling operations, but has now been resumed.

The earnings of drills operating under Revenue Vote, for private applicants, Government institutions and Native Purchase Areas, amounted to £6,947 after allowing for all rebates, and the running costs to £6,404, thus leaving a balance of revenue over expenditure of £543. The machines operating under this Vote were occupied on work for 64½ drill-months, and if the usual depreciation of £12 10s. 0d. per drill-month is allowed, the total depreciation would amount to £806 5s. 0d. As, however, a sum of £168 was spent on Drill No. 5 during the year, for a complete shop overhaul, it is considered that no depreciation need be allowed for that machine for the year.

This will reduce the total depreciation figure to £656, and if the excess of earnings over expenditure, amounting to £543, is deducted, the total debit balance for the year on these drilling machines would be £113.

In this connection, however, it must be pointed out that in addition to rebates granted in respect of unsuccessful boreholes drilled during this year, rebates have been granted during the year for unsuccessful boreholes drilled during the past ten years.

In future rebates should amount to considerably less per annum.

Details of the work performed by the drills operating under the Revenue Vote are set out in Schedule II., attached, and details relating to machines operating in Native Reserves are contained in my report to the Chief Native Commissioner.

Water Supply Installations in Native Reserves.—Pumping apparatus and troughs were erected on successful boreholes in the Reserves, but only two windmills with storage tanks were erected. The general opinion of Native Commissioners is that, except in the case of deep-seated supplies of water, a hand pump is all that is required.

As regards deep-seated supplies, it is the present opinion that such boreholes should be equipped with windmills, but it is hoped that it will be possible to try out a new type of animal draught gear during the next year; if this animal draught gear proves successful it will overcome the present difficulties of obtaining water with windmill apparatus during windless periods.

A great deal of work has been done in trying to evolve a more suitable design of hand pump, and a type has now been designed which it is considered will prove satisfactory and the cost of which is comparatively low.

Meteorology.—The number of stations at the end of this year is as follows:—

Equipment.	31.12.33	31.12.34
Dines Anemometers, etc.	6	6
Barometric	21	23
Climatological	24	19
Rainfall	549	550
Total	600	598

The work of checking and reduction of observations has, in spite of changes of staff, been kept up to date and the reduction of charts from stations other than Salisbury and Bulawayo has been started. The whole of the upper wind observations at Salisbury and Bulawayo have been tabulated in the form approved by the International Convention for Air Navigation and the tables appear in the Annual Report for 1933/34.

Weather Reports and Forecasts.—The interchange of daily weather reports by radio with Northern Rhodesia, Portuguese East Africa and Madagascar has worked very satisfactorily, and experiments are being carried out which are expected shortly to result in a daily exchange of reports with Nairobi covering the area up to and including Uganda. The number of reports sent to the Union of South Africa has been materially increased at their request, but the unsatisfactory system of receiving the Union reports in the form of a collective telegram is still in operation.

The system of distributing forecasts to Postmasters' offices only has never had the approval of this office and, with the Postmaster-General's consent, circulars have been posted at all post offices and postal agencies calling upon the public to enter a request at the Meteorological Office if they wish forecasts to be supplied. In response to this request applications have been received from Farmers' Associations and individuals at twelve post offices covering 78 persons and three of the Associations made general applications without stating the numbers. This arrangement has enabled this office to reduce the number of forecast telegrams by about 60% and has improved the distribution by including certain postal agencies. The Department of Agriculture, Nyasaland, has requested this office to supply daily forecasts to Zomba; in the absence of sufficient knowledge of the daily weather in Nyasaland it is not possible to achieve the standard of accuracy applicable to areas in Southern Rhodesia, but forecasts are being forwarded for what they are worth.

Aviation Meteorology.—At the beginning of the year under review the position in regard to aviation weather reports was viewed with some concern. During the year unremitting efforts were made to obtain approval for a scheme to provide

a general service for all aircraft during daylight hours; the organisation necessary for this purpose has now been approved and the service should be established during the present year.

The duplication of Imperial Airways service between Salisbury and Johannesburg during the year was met by the extension of the existing service, and the new services introduced by the Rhodesia and Nyasaland Airways Co. are receiving a skeleton service pending the introduction of the general service during the year. The establishment of a weather service between Nyasaland and Salisbury is largely due to the efforts of the Manager of the R.A.N.A., to whom our thanks are due.

Publications.—The Annual Report for the year 1933/34 was in the hands of the printers in November and proof-reading was completed before the close of the year. The usual monthly bulletins were prepared and published and forecasts, etc., issued. A special article was prepared for the Southern Rhodesia and East African Dependencies Supplement of the *Financial Times*. The indicated departure from normal of the seasonal forecast formula was insufficient to warrant the issue of a forecast.

Hydrography.—The Hydrographic Engineer (and Meteorologist) makes the following remarks:—

“The number of stations remains unchanged at thirteen. Attention should be drawn to the unsatisfactory position of this office. The work of the Meteorological Office, particularly in relation to aircraft, has increased enormously and, although staff has increased, the technicalities of the hydrographic work necessitates that it shall be carried out by an engineer, and the whole of it therefore falls on the shoulders of the Meteorologist, who is also the Hydrographic Engineer. As most of the meteorological work comprise the supply of urgent and pressing demands while the bulk of the hydrographic work comprises the collection and tabulation of data for the future, the latter is bound to suffer. Actually, apart from the requirements of the Water Court, which must be fulfilled within a fixed time, little or no work is being done on the

hydrographic side and, unless the matter is taken in hand shortly, the future will undoubtedly suffer from the loss of irreplaceable records."

This position has existed for a considerable period and the result is that hydrographic data is of such a meagre quantity as to be practically useless for the purposes of design, etc. The only way of carrying out the very necessary hydrographic work will be by the appointment of an Assistant Hydrographic Engineer

Water Ordinance.—The Chief Engineer and the writer sat as Official Members on four Water Courts during the year. In all ninety-three applications were dealt with, consisting of thirty-two irrigation, thirty-five mining, two urban and twenty-six miscellaneous applications.

Authority was sought to irrigate a total of 1,681 acres, but the irrigation of only 1,511 acres was authorised.

Of the total number of applications dealt with by the Courts four were dismissed, two of them being mining applications; a total of six applications were deferred pending further investigations.

The Hydrographic Engineer and the Acting Irrigation Engineer, Matabeleland, reported in detail on a number of applications, which thus saved expenditure by the Courts, as the Courts were not required to make visits to the areas concerned.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 29. April, 1935.

The locust position has remained quiet throughout the month.

The only species recorded is the Red Locust (*Nomadacris septemfasciata*, Serv.). The first adults of the new generation were reported on the 9th of the month in the Gwelo district, and another swarm was recorded in Salisbury district on the 12th. A few other swarms have since been reported in various districts, making a total of about nine swarms. Most of these are stated to be of large size. Information in regard to direction of flight has mostly been lacking. Probably the swarms have not as yet taken any particular direction.

Specimens, which had died from *Empusa*, have been received in two instances from the Mazoe district. In one case the whole swarm is stated to have settled and failed to rise again.

The appearance of adults of the new generation is much later than in 1934, when newly matured fliers were reported as early as February 24th. It would appear that only the later hatchings have matured, due possibly to subsidence of *Empusa* activity with the dry period, which commenced about the end of the first week in February.

RUPERT W. JACK.

Chief Entomologist.

Southern Rhodesia Weather Bureau.

APRIL, 1935.

Pressure.—Mean pressure for the month was distinctly below normal for practically all stations.

Temperature.—Mean temperature for the month was somewhat below normal.

Rainfall.—The Eastern Border received showers on the 1st of the month; thereafter rainfall throughout the Colony was negligible for three weeks. From the 23rd to the 25th rain, mainly of the "guti" type, fell in the south-east, east and north. The month's rain was well below the normal of .99 inch: very few stations receiving over an inch and several—chiefly in the south—none at all.

APRIL 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point F.	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.			Mean.										Ins.	Nor- mal	No. of Days	
			Max.	Min.	Max.	Min.	Max.	Min.	Nor- mal.	Dry Bulb.	Wet Bulb.								
Angus Ranch...	966.4	...	92	51	81.1	57.5	69.3	70.4	67.8	62.3	74	0.03	1.24	1	...	1,500			
Belt Bridge...	892.8	...	98	51	85.1	62.0	73.6	...	71.1	62.0	60	0.00	0.54	...	3,700				
Bindura...	869.8	...	89	50	78.5	55.6	67.1	...	64.9	59.1	70	0.29	1.75	3	4,426				
Bulawayo ...	870.6	...	86	47	78.0	52.8	65.4	65.9	64.4	55.6	56	0.11	0.77	1	3,685				
Chippinga ...	893.4	...	85	50	73.0	55.4	64.2	...	65.1	59.2	70	1.21	2.30	10	4,788				
Enkeldoorn ...	858.8	...	84	45	74.8	51.1	63.0	64.6	61.8	55.3	66	0.31	0.68	2	3,571				
Fort Victoria ...	897.3	...	89	46	77.7	52.5	65.1	65.0	66.1	58.2	62	0.10	0.68	1	3,278				
Gwaai Siding ...	905.5	...	93	46	86.0	52.7	69.4	...	66.8	57.4	56	0.01	1.42	1	3,229				
Gwanda ...	907.6	...	90	51	80.5	57.7	69.1	...	67.0	57.7	56	0.07	0.51	2	3,879				
Gwelo ...	863.7	...	84	45	76.4	52.1	64.3	65.5	63.6	56.0	62	0.00	0.71	...	5,514				
Hartley ...	886.6	...	86	46	79.3	51.2	65.3	68.0	63.9	58.0	70	0.36	0.72	3	4,090				
Inyanga ...	837.2	...	80	36	70.7	47.6	59.2	...	61.5	53.3	58	2.0	0.30	1.03	2				
Marandellas ...	838.5	...	79	45	70.9	50.5	60.7	...	60.1	54.1	67	2.5	1.02	1.28	3				
Miami ...	880.0	...	86	48	76.6	53.1	65.8	...	65.2	59.2	70	3.1	1.29	5	6,668				
Mount Darwin ...	908.9	...	91	46	79.8	53.8	66.8	...	66.4	60.8	73	4.3	0.03	0.55	1				
Mount Nuza ...	...	...	71	40	59.1	47.3	53.2	...	52.7	49.3	79	4.9	2.83	9	4,141		
Mtoko ...	878.7	...	87	49	76.7	55.5	66.1	...	65.1	59.2	70	5.5	0.58	0.55	2				
New Year's Gift...	...	...	91	49	80.3	55.4	67.9	...	63.8	59.2	77	...	0.68	0.72	7		
Nuanetsi ...	964.0	...	99	49	85.1	57.5	71.3	...	71.1	62.6	62	4.1	0.22	0.68	1				
Plumtree ...	865.4	...	85	50	77.9	55.1	66.5	...	65.6	60.2	73	57	1.4	1.15	1				
Que Que ...	883.3	...	87	46	79.5	52.0	65.8	...	65.3	57.1	60	51	2.6	0.07	0.72	1			
Rusape ...	863.4	...	85	44	74.3	50.4	62.4	...	60.8	56.0	74	53	3.4	0.20	1.17	1			
Salisbury ...	855.7	856.3	83	45	75.7	51.1	63.4	65.5	63.8	56.7	64	5.2	3.1	0.01	1.05	1			
Shabani ...	909.2	...	95	52	80.9	58.3	69.6	...	66.6	58.4	61	53	4.2	0.00	0.67	...			
Sinoia ...	889.8	...	88	43	80.7	52.7	66.7	...	65.1	58.9	69	55	2.2	0.29	0.98	2			
Sipitlo ...	886.3	...	85	48	76.5	54.8	65.7	...	65.8	58.7	65	54	3.1	1.40	1.25	4			
Stapleford ...	843.0	...	78	34	66.0	44.8	55.4	...	58.1	53.3	84	54	4.0	3.08	3.05	9			
Umtali ...	894.1	894.9	88	47	76.3	54.2	65.3	66.2	64.5	59.7	76	57	4.3	0.92	1.09	7			
Victoria Falls	94	54	87.7	61.0	74.4	...	68.0	60.1	63	55	1.6	0.12	0.64	1			
Wankie ...	928.3	...	94	59	88.0	63.7	75.9	...	71.9	61.2	54	54	1.8	0.60	0.60	3			

Southern Rhodesia Veterinary Report.

MARCH, 1935.

AFRICAN COAST FEVER.

Charter District.—Six cases occurred in the Greyling Centre and one in the Riversdale Centre.

Salisbury District.—The disease was diagnosed in two animals on the farm Nyaringondo. Arrangements were made for the immediate slaughter of the herd. The infection is attributed to a movement of cattle from the Charter area last June before the disease was discovered there.

FOOT AND MOUTH DISEASE.

Salisbury District.—During the month the disease spread to two farms adjoining infected centres.

TRYPANOSOMIASIS.

One case in the Hartley district.

HORSE-SICKNESS.

One case in Gwelo, one in Melsetter and several in Salisbury district.

TUBERCULIN TEST.

Thirty-two animals were tested on importation with negative results.

MALLEIN TEST.

Two horses and nine mules were tested upon entry; no reactions.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Cows 8, heifers 19, bulls 5, horses 2, mules 9, sheep 1,093, goats 110 pigs 16.

EXPORTATIONS.

Sheep 93.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom *via* Union Ports in Cold Storage:—Chilled beef quarters, 561; frozen beef boned quarters, 5,248; frozen veal boned quarters, 1,334; boned buttocks and rumps, 8,151 lbs.; boned middles, 2,465 lbs.; boned shoulders, 6,951 lbs.; boned briskets, 952 lbs.; tongues, 7,943 lbs.; livers, 17,565 lbs.; hearts, 5,380 lbs.; tails, 1,797 lbs.; skirts, 2,821 lbs.; shanks, 12,263 lbs.; kidneys, 2,127 lbs.; sweet breads, 102 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 17,496 lbs.; meat meal, 83,000 lbs.; beef powder, 28,225 lbs. From Rhodesian Export & Cold Storage Company: Beef fat, 21,380 lbs.; casings, 3,568 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Farming Calendar.

JUNE.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and *Bagrada* bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding

ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire-guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

JULY.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry our repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay

and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inches over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

FOR SALE.

Order your TOBACCO CURING RECORD BOOKS from The Art Printing Works NOW, 5/6 each, post free. Sample Sheet on request.—Phone 2428 or write Box 431, Salisbury.

ROSES.—*Rose Planting Season, June, July, and August.*—Our Rose Catalogue for 1935-36 is at your service, it contains the very best in Roses. My selection 12 trees 12/6. Customers' selection 16/6. FREE OFFER.—With every order of 4 dozen Rose Trees, 1 extra dozen will be sent gratis.—SAAYMAN'S ROSE NURSERIES, Uniondale, Cape Province.

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Lobelia Stricklandae H. B. Gilliland; the new Giant Lobelia from Manicaland. Photographed in a kloof behind the homestead of Mrs. Strickland's farm, Nodzi, Penhalonga. Specimens also occur at Ziani forest at m'Besa.

THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

JULY, 1935.

[No. 7.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Cattle Levy.—In terms of Government Notice No. 336 of June 7th, 1935, a levy of 10s. per head is payable on all cattle over 6 months old at the time of slaughter and 2s. on all calves under 6 months slaughtered, and this applies to every person who slaughters, during the year, more than 5 head of cattle for sale, barter or consumption in the Colony.

The levy is payable as from the 1st April, 1935, and will remain in force until 31st March, 1936.

Special return forms have been printed and may be obtained on application to the Accountant, Division of Agriculture and Lands, Salisbury, to whom completed returns and remittances should be forwarded on or before the 15th of each month following the month in which the cattle were slaughtered.

Special attention is drawn to the fact that forms must be completed for the months of April and May and payment made at the above rates on all animals slaughtered. If levy under the old Act has been paid for these two months the difference between the old levy and the present one is now due.

Tobacco Research Station: Plant Breeder Arrives from England.—Dr. A. A. Moffett who has been appointed as a Plant Breeder on the staff of the Tobacco Research Station, Trelawney, has recently arrived in the Colony and is spending some weeks in Salisbury studying the tobacco crop in the warehouses prior to taking up residence on the Station. Dr. Moffett graduated at Birmingham University, obtaining an Honours B.Sc. degree in Botany. He then held an appointment at the John Innes Horticultural Institution, Merton, Surrey, as Fruit Geneticist, and has been engaged for the last six and a half years in breeding new varieties of deciduous fruit, blackberries and nasturtiums. In the course of his studies Dr. Moffett obtained the Ph.D. degree of the University of London. We wish Dr. Moffett every success in his work, which will undoubtedly be of great importance to the tobacco industry of this Colony.

Mr. H. B. Gilliland.—We learn that Mr. H. B. Gilliland, the son of a well-known Salisbury resident, who came out to Rhodesia from London in April of last year as a Beit Railway Trust Rhodesian Fellow to investigate the Flora of Manicaland, has concluded his field investigations and returned to Salisbury.

During the course of his investigations Mr. Gilliland visited the Government Forest Reserve at Stapleford, the B.S.A. Company's m'Besa Forest Estate and the Rhodesia Pulpwood Company's estate at Inyanga. He also explored botanically the Honde and iNyumquarara valleys.

Mr. Gilliland has been working under the aegis of the British Museum, and we learn that he has despatched some 2,000 specimens to that institution as well as duplicates to the Royal Botanic Gardens at Kew and the National Herbarium at Pretoria. Specimens of the trees and shrubs have been sent to the Imperial Forestry Institute at Oxford.

While it is as yet too early to decide which are new species many new records for Rhodesia can be claimed, and at least one find of importance in the shape of the new Giant *Lobelia* illustrated.

Mr. Gilliland inclines to the view that the whole of Manicaland, with the possible exception of the higher mountain peaks, was once covered by a mountain forest of the type represented by the forests at Mt. Selinda and Mt. Garuso, in Portuguese East Africa, and also to a certain extent by the Ziani forest at m'Besa. It is probable that the Milanje Cedar (*Widdringtonia Whytei*) and the Yellow-wood (*Podocarpus* *sp.*) were better represented also in former times.

Mr. Gilliland has resigned his Fellowship from July of this year on his appointment to the staff of the Botany Department of the University of Witwatersrand, where he intends to continue his studies of the Rhodesia Flora.

Mr. Arthur Bouchier's Resignation.—Mr. Arthur Bouchier, who has now resigned from the post of Publicity Officer in the office of the Southern Rhodesian High Commissioner in London, and will shortly take up the position of Commissioner for the Tea Propaganda Board in South Africa and Rhodesia, has completed approximately seven years of valuable service at Crown House. During that time he has made a close investigation of the market possibilities in England for such staple Rhodesian products as tobacco, sunflower seeds, groundnuts, etc., and he has been instrumental in increasing the sales of Rhodesian tobacco in Great Britain. We take this opportunity of wishing him success and happiness in his new post.

Duty on Soya Beans.—Soya beans will cease to be exempt from the general 10 per cent. *ad valorem* duty as from August 1st, according to the resolution agreed to in the House of Commons recently. Sir P. Cunliffe Lister said its removal from the free list was to give effect to the established principle of Imperial Preference. This had been asked for by many Colonies, because the soya bean was an increasing competitor with the other oil substances which the Colonial Empire was producing. These included palm kernels, groundnuts and copra.

Imports of soya beans, mainly from Manchuria, were about 175,000 tons last year, with a value of about £1,000,000. Soya bean meal and cake are a by-product after the oil has been extracted from the beans for the manufacture of soap, margarine, paints, etc.

Numerous cases have occurred where losses amongst stock have resulted from the use of soya bean meal in the ration, but it appeared that these cases arose not from any bad property in this very useful and valuable food, but from the imperfect removal from the residual meal of the chemical solvent used for the extraction of the oil from the bean; such cases occur very seldom nowadays. When soya bean cake was first used as cattle feed much illness resulted, owing to the failure of the feeder to appreciate the high protein nature of this cake, with the result that the food was fed in excessive amounts, resulting in a ration far too rich in protein. Thus, in addition to being unnecessarily costly, the ration became definitely harmful to the consuming animal. It must be emphasised that the soya bean, properly used, provides animal food of very great value and absolutely safe. As far as is known the soya bean possesses no poisonous character.

Frozen Fruits.—It is reported from Canada that trial packs of frozen fruits and vegetables have been adopted by the Canadian public with unexpected favour and that their use is increasing. The sales of frozen strawberries and raspberries amounted to 6,000 lbs. in 1933; in 1935 the output is expected to exceed 100,000 lbs. In addition to small fruits, such vegetables as spinach, asparagus and peas have been successfully treated. This process will extend the season of Canadian fruit and vegetables, and it is probable that the frozen product may compete with and displace a part of the imports of fresh products. There is an increasing interest being taken in frozen fruits by large institutions, such as hospitals, which can freeze their own supplies and hold them for use.

Gas Storage of Bacon.—Experiments at Cambridge.—In a series of experiments conducted by Dr. E. H. Callow, at the Low Temperature Research Station at Cambridge, a side of

tank-cured bacon was stored at 32° F. for 18½ weeks in an atmosphere of carbon dioxide. At the end of this time it was exhibited in the unsmoked state at Smithfield. According to expert opinion its appearance was hardly distinguishable from that of fresh bacon. There were no signs of micro-organisms, and the colour was very bright. The side was then smoked, cut up and distributed to experts for tasting tests. The results of these tests showed that the bacon had kept remarkably well. There was no sign of rancidity in the fat, and the colour and the flavour of the lean was excellent.

Lower temperatures of storage were then used in order to see whether still better results could be obtained. Two sides, A1 and A2, from the same pig were dry-salt-cured and stored unsmoked at 26.6° F. Another pair of sides, B1 and B2, were hard frozen at 22° F. and stored at 14° F. Sides A1 and B1 were stored in air, and sides A2 and B2 in an atmosphere of carbon dioxide. After eight months' storage all the sides were defrosted and smoked. The smoked sides were exhibited in London and taken back to Cambridge, where samples were tested. Other samples were distributed to members of the industry for additional tests.

The results showed that both sides stored in air dried out badly, and the surface of the fat was very rancid. Owing to the rapid circulation of air in the room at 26.6° F., the side A1 was dried out so much that the interior fat had been protected from rancidity. In the side stored in air at 14° F. the fat was rancid throughout, and a yellow colour had developed in many places. There was no sign of rancidity in the fat of the sides which had been stored in carbon dioxide.

The appearance of the gas-stored bacon was indistinguishable from that of fresh bacon. After being cooked the lean of the gas-stored bacon at 26.6° F. was possibly more friable than fresh bacon, but that stored in carbon dioxide at 14° F. was just like fresh bacon. A striking point about the gas-stored bacon was that the loss in weight during storage was almost negligible. This was probably due to the fact that it was kept in a closed container.

The foregoing experiments have all been carried out in gas tight metal boxes capable of holding a carcase of pork

or four sides of bacon. In order to study gas-storage on a larger scale under factory conditions, a gas-store capable of holding 30 to 40 sides of bacon has been constructed, and the investigations are being continued on a larger scale.

Stock Improvement.—The following conditions under which stock-owners may obtain financial assistance from the Government for the improvement of their livestock are published for general information.

The objects of the scheme are to afford encouragement and assistance to breeders in the Colony of pedigree, or sufficiently improved, cattle, sheep and pigs, to further improve the quality of their stock by introduction of bulls, rams or boars from overseas, and at the same time similarly to encourage and assist other breeders to effect improvement in their herds or flocks.

In the case of breeders of pedigree, or sufficiently improved, cattle, sheep or pigs, whose applications are approved by the Minister of Agriculture and Lands, and subject to the conditions which have been published in the daily Press, the Government will contribute towards the cost of the importation of sires on the following basis:—

(a) *Animals Imported from the United Kingdom.*—Pedigree bulls imported direct from the United Kingdom, a sum not exceeding half the original certified cost of the bull, provided that the total contribution in respect of any one animal shall not exceed £50.

Pedigree rams or boars imported direct from the United Kingdom, a sum not exceeding half the original certified cost of the ram or boar, provided that the total contribution in respect of any one animal does not exceed £12 10s.

(b) *Animals purchased in this Colony or imported from any Territory in South Africa.*—Approved bulls purchased in this Colony or in any territory in South Africa, a sum not exceeding half the original certified cost of the bull, provided that, only under very exceptional circumstances approved by the Minister of Agriculture and Lands, shall the total contribution in respect of any one animal exceed £15.

Approved rams or boars purchased in this Colony or in any territory in South Africa, a sum not exceeding half the original certified cost or the ram or boar, provided that the total contribution in respect of any one animal shall not exceed £4.

Farmers who desire assistance in terms of this scheme should apply to the Secretary, Department of Agriculture and Lands, Box 387, Salisbury, giving particulars of the stock required, but no definite steps should be taken to purchase any animal until a grant has been approved. It should be noted that assistance towards the remainder of the purchase price may be available from the Land Bank on the usual stock loan terms afforded by that institution.

Breeders who have pure-bred bulls, rams or boars for sale, which are likely to be suitable for use in the stock improvement scheme, are invited to send full particulars of the animals for sale to the Secretary, Department of Agriculture and Lands, Box 387, Salisbury, who will cause the information supplied to be brought to the attention of interested purchasers.

Boron Deficiency in Tobacco.—A short article of considerable importance to tobacco growers appeared in the April number of *The Journal of the American Society of Agronomy* on the effects on tobacco plants of boron deficiency in the soil. The writer is Mr. J. E. McMurtrey, one of the plant physiologists of the United States Department of Agriculture. Experiments were carried out at one of the Maryland Experiment Stations, using ordinary chemical fertilisers and growing tobacco on the same plots since 1928.

In 1933 the tobacco developed the characteristic die-back of the terminal bud previously described as distinctive for boron deficiency when the plants were grown in solution cultures and in pot cultures with soil and sand. Since this condition was more or less common on all treatments, there was no absolute check as to whether it was due to boron shortage. However, on a plot in another series fertilised with a mixture in which the potash was derived from a commercial potassium chloride containing boron, this die-back of the terminal bud was not observed.

In order to determine if the diagnosis of this trouble was correct, boron was applied in 1934 at the rate of 5 lbs. per acre of chemically pure boric acid (H_3BO_3) to two plots and omitted from duplicate treatments in this series.

On plots which received no boric acid the characteristic effects of boron deficiency again were apparent, being particularly marked on one of them. The effects did not develop where boron was supplied. It is important to call attention to the fact that boron may become toxic to plant growth unless used in very small quantities. No toxicity was observed with the quantity used in this instance.

The following are distinctive effects of boron deficiency on tobacco. First, the young leaves composing the bud exhibit a light green colour, the bases of the individual leaves manifesting a lighter green than the tips. When this condition appears, the bud leaves have ceased to grow and exhibit a somewhat drawn appearance. This condition is followed by a breaking down of the tissue at the base of the young leaves making up the bud. Death of the terminal bud is the final manifestation. The automatic topping of the plant results in a thickening and an increase in area of leaves. Finally, the leaves become glabrous and brittle, and when the midrib is broken, the vascular tissue shows discolouration. The upper leaves tend to roll in a half circle downward from the tip toward the base. When the boron deficiency is not too extreme so that lateral buds (suckers) develop in the axils of the leaves or at the base of the stalk, these generally break down, as described above.

When the earlier stages do not progress too far and the young leaves later make fair growth, they may be distorted by twisting to one side because of growth around the injured tissue. The stalk toward the top of the plant in the same fashion may show a one-sided or twisted growth.

Summary.—The recent trend towards the use of relatively pure chemicals in the fertiliser industry emphasises the importance of all elements essential to plant growth. After using such chemicals in preparing fertiliser mixtures for tobacco on a sandy soil for a period of 5 years pronounced effects of boron deficiency became apparent.

The Soya Bean.—The following is a notice just received of a book by Elizabeth Bowbridge, published by the Oxford University Press, 6s. net.

“Here is a reliable guide for the use of agriculturists and others on the cultivation of that remarkable product of nature, the soya bean. This bean, which has been cultivated for centuries in the East, and within recent years with such enormous success in the United States, has at last been grown as a field crop in Great Britain. The widespread interest in this achievement has been followed by a demand for information on the plant’s cultivation, and *The Soya Bean, its History, Cultivation and Uses*, is offered in response to this demand. No other work of the kind has been published in England. The farmer in search of a supplementary hay crop, or a forage crop for green feed throughout the summer and autumn, will find it of outstanding value. It treats on soya as a soil improver for the benefit of succeeding crops and as a green manure to restore the fertility of poor soils. In addition to detailed information on the cultivation of the plant, together with a full account of the experiments conducted in the past two years, a great deal of interesting material on the values and uses of the by-products has been included. In considering the possibilities of the soya bean as a new crop for the British farmer the student of agriculture will welcome this handbook, as will the physician in his search for a cheap source of protein.”

NOTICE.

TUNG OIL FRUIT (CLUSTER TYPE) REQUIREMENTS, 1936.

To enable the Department of Agriculture and Lands to ascertain in advance the requirements of intending growers of Tung Oil (*Aleurites fordii*) during the year 1936, farmers and others are invited to furnish their requirements under this heading to the undersigned not later than 31st August, 1935.

It is estimated that the cost of Tung Oil seed in fruit form to consignees' stations or sidings will be approximately 2s. 3d. per lb. of fruit for the year in question, but no definite assurance can be given at this date that the above cost will not be exceeded.

Orders should be accompanied by cash or cheques endorsed by the Bank and made payable to the Accountant, Division of Agriculture and Lands, Salisbury, on 1st January, 1936.

The Government only accepts orders and cash deposits on the clear understanding that no legal liability shall attach to the Government if it fails, for any reason whatsoever, to fulfil the whole or any portion of an order.

Applicants will be held liable for the cost of their requirements if between the date of application and the date of delivery they decide to withdraw their order.

Whilst every endeavour will be made to supply the full requirements of applicants, no guarantee will be given that such quantities will be available. If it is found that supplies of seed will not enable this Department to meet in full the orders placed with it, the Department reserves to itself the right to make a *pro rata* distribution of seed in fruit form.

Tung Oil seeds are sold in fruit form to assist in the preservation of the seeds' viability.

There are approximately 76 seeds per lb. of fruit, and a germination percentage of about 50 may reasonably be expected while the seed is fresh. No guarantee is, however, given.

Under normal circumstances, fruit should be available for distribution about February, 1936.

H. G. MUNDY, Secretary,
Department of Agriculture and Lands.

GOVERNMENT NOTICE.

Cattle Cleansing Act, 1934.

IT is hereby notified that His Excellency the Governor has been pleased, under the powers vested in him by Section 26 of the "Cattle Cleansing Act, 1934," to prescribe the following form of petition to be submitted for the purposes of Section 8 of the said Act:—

FORM OF PETITION.

The owners of cattle in the area described as follows:—

.....
.....
.....

petition that His Excellency the Governor may be pleased, under Section 8 of the "Cattle Cleansing Act, 1934," to apply the provisions of Section 6 of the said Act during the months of to in every year, to such area.

Signature of Owner.

Farm.

No. of Cattle.

NOTICE.

IRRIGATION LOANS.

At a recent meeting of the Soil Conservation Advisory Council it was considered that publicity should be given to the conditions under which irrigation loans are available for the construction of soil conservation works, as apparently the easy terms under which these loans can be obtained are not generally realised by farmers. These loans are normally available under the following terms:—

- (a) Interest at the rate of $4\frac{1}{2}\%$ per annum, and if desired the interest charges can be funded with the loan for the initial three year period during which no repayments are necessary, and the whole sum thereafter repaid in annual instalments up to a maximum period of 17 years.
- (b) The loan to be secured by notice to the Registrar of Deeds for registration against the title deeds of the property concerned, or on the personal security of two sureties who must be holders of immovable property in Southern Rhodesia.
- (c) One-fifth of the loan can be paid out as soon as the applicant is ready to start the works, and the balance is paid on the certificate of an engineer of the Irrigation Division that the works have been satisfactorily completed and are valued at the amount covered by the loan.

In addition to the above financial provision an arrangement has been made with the Premier Portland Cement Company (Rhodesia) Limited, whereby supplies of cement at reduced rates are available to farmers for use in water conservation works as under:—

1. Farmers who obtain a loan from Irrigation Loan Funds or from the Land Bank for the purpose of constructing water conservation works can obtain the cement required for the construction of these works on a

Government requisition at a reduced price of 2s. 9d. per bag (95 lbs.), f.o.r. Cement Siding, in minimum lots of 24 bags. The requisition for the supply of the cement will be issued by the Irrigation Engineer responsible for the inspection and supervision of the works proposed.

2. Farmers who do not desire a loan and are willing to pay cash for the cement required for the construction of water conservation works, may obtain the benefits of the reduced rates subject to the following conditions:—

(a) A cheque in favour of the Premier Portland Cement Co. (Rhodesia) Ltd., should be sent to the Chief Irrigation Engineer, Box 387, Salisbury, or to the Irrigation Engineer (Matabeleland), Box 566, Bulawayo. Such cheque to cover the cost of the cement at ordinary rates, namely, 3s. 7½d. per bag (95 lbs.) for lots of 50 bags or over, and 3s. 9d. per bag for smaller quantities limited to a minimum order of 24 bags, plus railage charges if the cement is to be consigned to a siding and the railage charges have to be prepaid.

(b) After an inspection of the works by a Government engineer and certification that the cement has been utilised in the construction of these works, the difference between the price paid and the reduced price of 2s. 9d. per bag will be refunded to the farmer by the Cement Company.

Applications for these loans should be made to the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury.

H. G. MUNDY,
Secretary,
Department of Agriculture and Lands.

The Selection of a Dairy Bull.

By A. E. ROMYN, Ph.D., Chief Animal Husbandry Officer.

In most dairy herds the bull represents the chief influence for increasing production; yet it is no exaggeration to say that there is no important method of improvement so generally neglected in the Colony as the use of a good bull.

Provided the bull is pure bred most breeders seem to feel they have done all that is essential and pay little attention to the ancestry of the bull they are using. It is not uncommon to meet owners of comparatively good dairy herds who do not know the name of their herd sire or anything about its breeding except that it is pure bred and they bought it from or through so and so.

In the present depressed state of the livestock industry this lack of interest is perhaps to be expected, though less so in the case of a dairyman than a rancher. The position of the dairyman will, however, certainly not improve fundamentally until the average standard of the bulls in use is raised, and these notes are written to stress the importance of a good bull and to indicate the general lines which should be followed in the selection of dairy stock.

GENERAL CONSIDERATIONS.

1. **Conformation.**—It is necessary to know something of the relation of conformation to production before selecting a dairy bull or cow.

There has been a tendency recently to neglect conformation for production. With the advent of proper milk recording it was soon noticed that many valued characteristics—such as the shape and size of the escutcheon for instance—had no real connection with the capacity of a dairy cow to produce milk. In fact, it has been realised that the production of a cow cannot be reliably foretold from her conformation. Many beefy cows are great producers and *vice versa*.

The neglect of conformation for production generally results in the development of a cow with a large capacity to produce but without the framework or stamina to maintain this production over a long period. Buchanan Smith⁽¹⁾ has said, it is almost as senseless to produce a cow of this description as to breed a racehorse with the ability to move at a great speed but with a heart too weak to stand the strain of racing.

Cows selected solely on their records may produce very large yields under favourable conditions, but they more often break down under the strain of continued heavy lactations and have to be discarded comparatively early in their productive life. In fact, it has been suggested that a better comparison standard for dairy cows than the usual 300 day record would be the age by which they had produced, say, four or five thousand gallons of milk, as, to do this at an early age, the cow would have to be a ready breeder and have a good constitution.

There are, moreover, some points of conformation which have been shown to bear a definite relation to the productive ability of the cow. The size of the cow and the diameter of her milk wells are, for instance, of considerable importance in indicating her ability to produce, and it has been shown that the larger the cow and the greater the diameter of the wells the greater is the likelihood of her production being good.

There are other signs as well which, though they may not give a definite indication of the capacity of the cow for milk production, are usually of great value in indicating the probable value of the cow from a standpoint of lifetime production. Chief among these are the legs and feet, shape of the udder and teats, size of the barrel and femininity of the cow.

Good legs and feet enable a cow to travel well and sustain the strain of standing for long periods on concrete floors. A well shaped udder is less likely to be damaged than a pendulous one. Well shaped teats are easy to milk and not so likely to be abused by native milkers as hard or mis-shapen teats. A good barrel gives the capacity to take in feed in the large quantities necessary to sustain a heavy milk yield. A feminine

expression is an indication that the cow is well ordered sexually and, other things being equal, she is probably a better producer than an ox-like sister.

It will readily be appreciated also that conformation is of great importance in the case of the dual purpose breeds of cattle, such as the Dairy Shorthorn and Red Poll, as there is at present no way of telling whether an unproven cow is likely to breed a good bullock except by her conformation.

Fortunately the dairy and dual purpose breed societies in South Africa have not neglected conformation. Some breed societies, in fact, arrange for inspection of the cattle before they are fully registered and do not register any animal which does not come up to a certain standard of conformation. In these breeds buyers are protected to a certain extent when buying stock, as they can demand only bulls or cows which have been inspected and passed for registration. Such animals are not likely to have serious faults in conformation.

The Friesland Society of South Africa has taken the inspection service a step further and provision is made for the definite scoring of the animal inspected. This score and the attendant remarks on the certificate give the buyer a valuable guide to the conformation and type of any animal under consideration.

Finally, a good conformation is pleasing to the eye of most people and has a definite financial value.

As conformation is inherited the bull should be a typical representative of its breed. What are generally termed "fancy points," such as the turn of the horn and the colour pattern, should not be emphasised in choosing a herd sire, but it is important that he should be well grown for his age and breed, masculine, robust and have good legs.

If possible, therefore, inspect the sire and dam carefully and any available progeny or relations of the prospective sire and see if their conformation is satisfactory. The average appearance of his half sisters and half brothers, both from his dam and sire's side, often given a good indication of the conformation that the bull is likely to transmit to his own progeny.

Production (Milk Records).—The milk records of a dairy bull's immediate ancestry are a good indication of his probable powers of transmission for production. They are, as has been emphasised, usually a much better indication of this ability than his conformation.

In the same way as conformation, milk yield is a heritable character. The actual milk yield is, however, very largely influenced by nutrition and environment. The quality of the milk (butterfat test) is also a heritable character, but is influenced far less by outside factors than the milk yield. It is, therefore, a particularly valuable index to us of the capacity of an animal to produce, as milk yields under our conditions are often unreliable on account of wide variations in the seasons and in the handling of the cows. A good butterfat test is, therefore, most important. A high butterfat test is of further importance, as it is usually associated in the milk with high "solids not fat," which are apt to be low in South Africa.

The records of the immediate ancestors of a bull are of greater importance than those further back in its pedigree.

On an average, fifty per cent of the inheritance of any individual comes from the two parents and twenty-five per cent. from the four grandparents. The probable share left to all the remainder of its ancestors is, therefore, comparatively small and an outstanding individual in the third or fourth generation will probably play a very minor part in determining the inheritance of a particular animal and, for practical purposes, should not carry much weight in assessing the value of a pedigree.

A study of the back generations in a pedigree gives, however, a record of the system of mating and the lines of breeding that have been followed to produce the bull under consideration and, as will be shown later, is of definite value in determining whether the bull is likely to nick or not with the cows in the herd for which it is required.

The best pedigree is the proven one in which a bull has actually shown what he can do by the records of his daughters. Bulls with proven pedigrees are seldom for sale, however, and it is usually necessary to be satisfied with one with a promising pedigree as shown by the records of its ancestors.

In assessing the value of the pedigree of an unproven bull first consideration should be given to the sire of the prospective herd bull.

The sire should be a bull which has shown his ability to transmit high production to his daughters. The records of the daughters should, therefore, show an improvement on those of their dams, the necessary corrections having been made for age. Due weight must, however, be given in each case to the production of the dams, as a bull which can maintain the standard of production of a high producing group of cows is more valuable than one which has only raised the production of a low producing group of cows. In any case, the average production of the daughters should be above the average production desired in the herd and, in the case of a pure bred herd, above the generally accepted average of the breed.

If these records of the sire's daughters are not available look up the records of the sire's half sisters on both sides, as they are of value in indicating his probable transmitting powers. The tendency will ordinarily be for him to pass on the average production of these groups. The records of these half sisters show the ability of the paternal grandparents to transmit high production. If they had this power, it is likely that the sire has inherited it in some measure and that he has, in turn, passed it on to the bull under consideration.

Next turn to the dam's records. If possible get:—

- (1) The record of the dam, which should be a good one;
- (2) The records of the dam's half sisters by the same sire: these are important as, if the cow is an exceptionally high producer, she is more likely to transmit the average production of the whole half sister group than her own production;
- (3) The records of the dam's offspring.

A general summary of these records should give a very good idea of the probable transmitting power of the cow, the dam of the prospective bull.

If necessary, the records of the paternal and maternal great grandparents can be consulted to see if these individuals showed good transmitting powers, but this usually is getting too far back in the pedigree to give a reliable indication of breeding powers, unless supported by other evidence.

Special consideration should always be given to any information available in regard to the performance of full brothers and sisters of the prospective bull if these are available. The records of two or more full sisters or brothers generally give a good indication of what a full brother will do.

In every case care must be taken to secure all the records available and not those of selected cows only.

In cases where some of the information outlined is not available, the practical course is to get as many particulars as possible about the bull and the performance of his parents and grandparents and piece the information together.

The Bull Index.—The Bull Index has been invented to simplify the assessment of a pedigree and to provide a convenient single figure for purposes of comparison.

There are several indexes in use of which the "Mount Hope Index" has probably had the most publicity in this country. All the indexes are based on the average production of the sire's daughters but differ in the use that is made of this average in calculating the "Index of the bull."

It must be emphasised that, unless the records on which the index is based are made under comparable conditions the figure arrived at may be misleading, if not inaccurate. There is unfortunately a great deal of variation in conditions under which records are made in this country and consequently the reliability of any local bull index in the present stage of the industry is open to question. An index, however, if properly interpreted, gives some information of value and a useful comparative index figure, even under local conditions, can be arrived at where the records are available by calculating the average mature production of at least five daughters, preferably more, of the sire and comparing it with the average mature production of their dams.

The index of the bull can then be expressed as the percentage increase, or decrease, in production of the daughters in relation to the dams. The average production of the dams should be stated at the same time as a measure of the level of production which has been influenced, *e.g.*, the bull may have given a 10% increase on a mature production of 350 lbs. of butterfat in 300 days.

Friesland Bull Index Register.—The Friesland Cattle Breeders' Association of South Africa has developed a Bull Index Register.

This Register supplies all the raw data (uncorrected for age) available about a bull, but does not express his value as a formula or index.

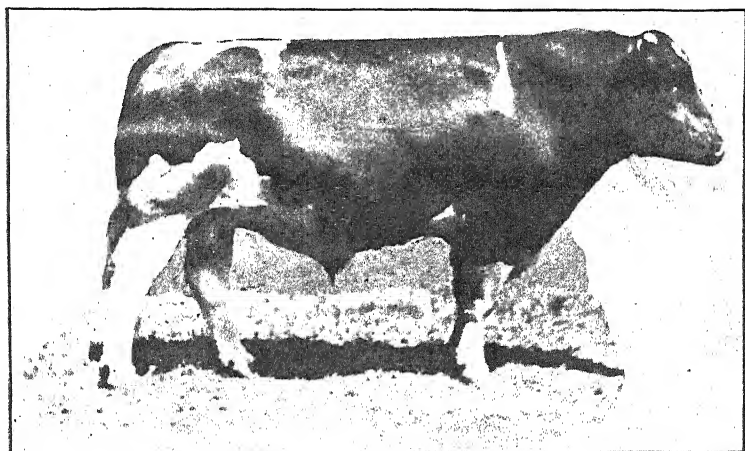
This Register is a noteworthy attempt to tabulate the milk records of a bull's daughters and their dams and to make them available in a form helpful to breeders. Any breeder of Frieslands buying a bull with the definite purpose of improving his herd will be well advised to find out first if there is any information in this Register bearing on the bull he proposes to buy. An example of this Register, taken from the *Friesland Journal*, appears at the end of this article.

It needs careful study to weigh up properly the particulars given in regard to milk yield, but the information about butterfat is given in graphic form and can be assimilated at a glance. If the majority of the dots is to the right of the diagonal line in the diagram the bull has tended to raise the butterfat percentages of his daughters.

The Breed of Bull.—Choose a breed that suits your conditions, preferably a breed that is popular in your district and, generally speaking, stick to this breed. Do not cross breed. Where a suitable breed has been chosen the desired characteristics can usually be obtained and fixed within the breed by proper selection.

The Method of Breeding.—There are four more or less definite systems of breeding within a breed. These are generally described as in-breeding, line-breeding, outcrossing and grading.

Of these line-breeding is the system of breeding usually recommended for the grading up of a dairy herd. By line-breeding we ordinarily mean the using of successive sires which have common ancestors, *i.e.*, of the same family or blood lines but far enough removed so that the relationship between the successive sires is less than 50% but not more than 25% of the same blood.



Lodewyk Achilles.—An outstanding dairy sire. This bull has raised both the milk and butterfat records of his daughters.

This system tends to fix the desired characteristics at a reasonable rate without running the risks of in-breeding or the danger of too much variation, which arises when using a bull quite unrelated to a previous sire.

Where to Buy a Bull.—Unfortunately, the supply of suitable dairy bulls in this Colony is far short of the requirements, and for some time to come it will be necessary to import the majority of the bulls needed.

When importing bulls, whether buying directly or through an agent, deal as far as possible with breeders of established reputation and try to confine the selection of the bull to proven strains. The beginner is well advised to consult the Secretary of the Breed Society concerned for advice before making a final selection. In some cases the Breed Societies have the organisation to report on and ensure that the bulls sold under their auspices are of a desirable standard.

In the case of at least two of the dairy breeds, information in regard to the records of the production of animals registered has been methodically tabulated and the information is available to *bona fide* enquirers. The Secretaries of these Societies also have a good knowledge of the conditions under which these records have been made and can give proper weight to the different records as published.

As far as local breeders are concerned, this Department is often in a position to assist with general advice as to stock available and, in some cases, can help in the actual selection of the bulls required.

The Cost of the Bull.—The range and standard of selection will depend largely on the price which can be paid for the bull.

A good bull will give returns on a high investment, a poor bull is expensive at any price. Considering the great influence the bull may have in the herd, a breeder is generally considered to be justified in spending on the bull a sum equal to 10 or 20% of the total investment in the cows to be served⁽²⁾. Thus, if the cows are worth £500 (50 at £10) a bull costing from £50 to £100 would be justified.

On the basis of this calculation and at to-day's prices for butterfat there are few herds in the Colony which are regularly milked which would not justify the expenditure of at least £30 on a bull. There are some that would justify the use of a bull costing £150—£200. Many dairy farmers are, however, either on account of lack of foresight or lack of funds, using bulls which, though they cost much less than these amounts, are dear at the price paid for them.

Financial assistance to purchase bulls can be obtained both from the Department of Agriculture and from the Land Bank, and farmers interested in the matter are advised to write to these Departments for information.

2. **The Purchase of a Bull.**—There are some rules that it is well to follow as closely as possible in buying a bull. These are:—

1. Don't be in a hurry. The selection of a bull is an important matter.

2. Find out if a suitable bull can be obtained locally, the closer to your farm the better. Such bulls are likely to be better acclimatised than those that come from a distance. If the bull is nearby it should be possible to inspect him, his sire and dam and, possibly, his progeny, or to arrange for a trustworthy report before the bull is purchased.

3. If no suitable bull is available in the Colony, the Union of South Africa is usually the next best source, unless an outstanding sire is required.

For the small man the best time to purchase bulls in the Union is usually at the April or September stock sales. From the veterinary standpoint these sales are held at a good time of the year to import cattle into the Colony and are usually attended by Rhodesian buyers, which makes it possible to arrange for stock purchased to be combined in truck loads and so save railage.

4. Whenever buying arrange, if possible, to deal with an established breeder and buy a bull in whose pedigree desirable lines of blood are well represented.

If a farmer is not familiar with these lines or families it is advisable for him to consult the Secretary of the Breed

Society concerned or an experienced breeder with a good knowledge of the breed history and performance. These people can give a reliable opinion on the value of a pedigree. The better the pedigree the better is the chance that the bull will do well.

5. Where you cannot get a proven sire, which is unfortunately too often the case, buy a young bull. A young bull has a longer useful life ahead of it, is easier to handle, easier to sell and a more active worker than an old bull.

6. Buy a bull whose conformation and records indicate that he should improve your herd in the directions required.

7. Bear in mind that a bull wisely selected may easily pay for himself in the increased value of one crop of heifers, and any man to-day, who uses a dairy bull without sufficient production behind it for the purpose in view, is doing a foolish thing.

References.

- (¹) A. D. Buchanan Smith. Journal Ministry of Agriculture. Vol. XLI., No. 7, October, 1934.
- (²) H. E. Selby and I. R. Jones. Oregon State Agricultural College. Bull. 312.

The Rhodesian Home Orchard.

By G. W. MARSHALL, Horticulturist.

Introduction.—In this article it is proposed to deal mainly with the general purpose or utility orchard for the farm or town plot in which the owner wishes to plant a selection of fruit trees to meet the household's fruit requirements.

Fruit may be regarded as an essential part of our diet, and if we wish to maintain good health an endeavour should be made to produce throughout the year a regular supply of fruit. This is possible in many districts of Rhodesia, for we have a wide range comprising tropical, sub-tropical and temperate fruits to choose from, and with judicious selection a sequence of fruits may be produced to furnish the home requirements from January to December.

A comparison of existing home orchards in Rhodesia is enlightening. They vary from exceptionally good to extremely poor. In the former case there is evidence of a natural love for orchard management, the trees are well tended, the fruit crops are good in quality and quantity and are a real joy to the owner. In other orchards are trees planted carelessly, neglected and an eyesore to all who see them. Many of these failures are due to lack of knowledge concerning the planting and subsequent cultural requirements of the trees, to planting of varieties unsuitable for the purpose they were intended to fulfil or to the planting of more trees than were actually required or could properly be attended to.

An endeavour will be made in the succeeding pages to deal with the many factors that need consideration when establishing and maintaining a home orchard, and it is trusted that the advice tendered will be of assistance to those about to establish, extend or improve their orchards.

Selection of the Orchard Site.—The most important factors to consider when selecting a site for a home orchard are suitability in respect to—

- (1) soil;
- (2) shelter;
- (3) aspect;
- (4) irrigation possibilities; and
- (5) distance from homestead.

If one or more of these factors are disregarded, poor and unprofitable fruit may very well be the result.

Soil.—The best soil for the profitable production of most fruits is a light to medium loam with good depth and drainage. Suitable soils as described above will furnish the trees with a large root-feeding area, the trees will be capable of growing to a good size, living to a great age and producing large crops of good fruit. If there is no soil of this nature available it then becomes necessary to be content with a heavier soil. Heavy soils, however, are undesirable; they are more difficult to work, and the quality of the fruit they produce is often poor, particularly during the wet seasons, and they should be avoided if lighter soils are available.

On shallow soils with impervious sub-soils young trees may thrive and flourish for a few years, but when the roots encounter the objectionable sub-soil the trees will rapidly decline or die and prove a great disappointment to the owner.

The minimum depth of a good fruit tree soil should be not less than four feet, and to this depth the land should be naturally well drained. Soils containing small stones throughout their entire depth or those overlying gravelly sub-soils are suitable for tree-planting, provided the tree roots are able to penetrate to the requisite depth, namely, four feet or more.

Shelter.—Owing to the harmful effect of dry winds during spring or the blossoming months upon the setting of the fruit, it is imperative that all orchards should be adequately protected from such winds. Having selected a suitable soil for the orchard, shelter belts; unless already existing naturally, should be established without delay. It is to the advantage

of the fruit trees if shelter belts which are required to be established are planted a few years in advance of the orchard they are to protect.

Young fruit trees require protection from the time of planting if the best results are to be assured. This is not always feasible, however, particularly with new arrivals to the country who desire to establish orchards without unnecessary delay. In instances such as this the shelter trees should not be planted later than the fruit trees they are to protect, and meanwhile rows of some of the more quick-growing temporary shelter plants may be grown at close intervals around and through the orchard to afford temporary protection until the permanent trees become effective.

When the orchard is enclosed, as it should be, by wire netting or fencing to exclude domestic animals, small buck and ground vermin, a temporary shelter can quickly be produced by planting granadilla vines at ten feet intervals along the fences; when the vines have covered the fence a few additional strands of wire may be erected above to enable the vines to form a screen of at least six feet in height. Other creepers may be used in place of the granadilla, but the latter is preferable, as it produces an edible fruit. Bananas and plantains are useful shelter plants; they grow quickly and produce good fruit. Dhal also is useful for a temporary hedge, the foliage and grain being valuable poultry food.

The best time of year to plant all shelter trees is during the months of December and January; by planting at this season, when rains are usually frequent, it should be possible to establish the trees before the dry season commences. It is seldom necessary to plant shelter trees on more than three sides of the orchard, the idea being to exclude the prevailing hot and dry winds that are prevalent from July to November. The sides of the grove usually requiring protection are the south-east and north-west, as it is from these directions that most of the winds are experienced. If the west, south and east sides are protected, little or no tree or fruit injury will occur. No shelter trees should be planted nearer than 60 feet to 70 feet from the fruit trees; this distance appears to be ample for Rhodesian requirements.

The varieties of trees recommended for shelter belts are :— Tall-growing trees for outer rows—*Eucalyptus tereticornis* and *Eucalyptus saligna*; the latter do best at the higher elevations. If eucalyptus trees are objected to and the soil is sufficiently light, *Pinus insignis* will be found suitable for the outer rows, and for the inner rows *Callitris calcarata*, *Callitris robusta*, *Cupressus torulosa* and *Cupressus lusitanica*, but the last-named only where the rainfall is heavy or irrigation is possible.

Many other varieties are suitable and may be planted, but those specially mentioned will furnish a sufficiently wide range to select from for average climatic conditions.

When two or more rows of trees are planted to form a shelter belt they should be spaced 8 feet apart in the rows and 10 feet between the rows. "Staggered" trees give the best results, *i.e.*, like the teeth of a saw.

Aspect.—The best aspect to select for the orchard is one with a gentle southern and eastern slope. Northern and western aspects are often undesirable. The slope of the site should not be excessive, or soil erosion will be liable to occur during heavy rain storms or irrigation. The best slope will vary with the nature of the soil, but it should never if possible exceed one in a hundred.

Irrigation Possibilities.—Preference should be given to a site capable of being irrigated by gravitation, provided the shelter, soil and aspect factors are right. Good fruits may be grown in Rhodesia without irrigation, but if irrigation can be made available, so much the better.

Distance from Homestead.—The orchard site should be as near the homestead as possible, but the other factors must not be disregarded when making the choice. Orchards distant from the homestead are more liable to be neglected, cannot be kept under such close supervision and are subject to greater losses through depredations by birds and by theft.

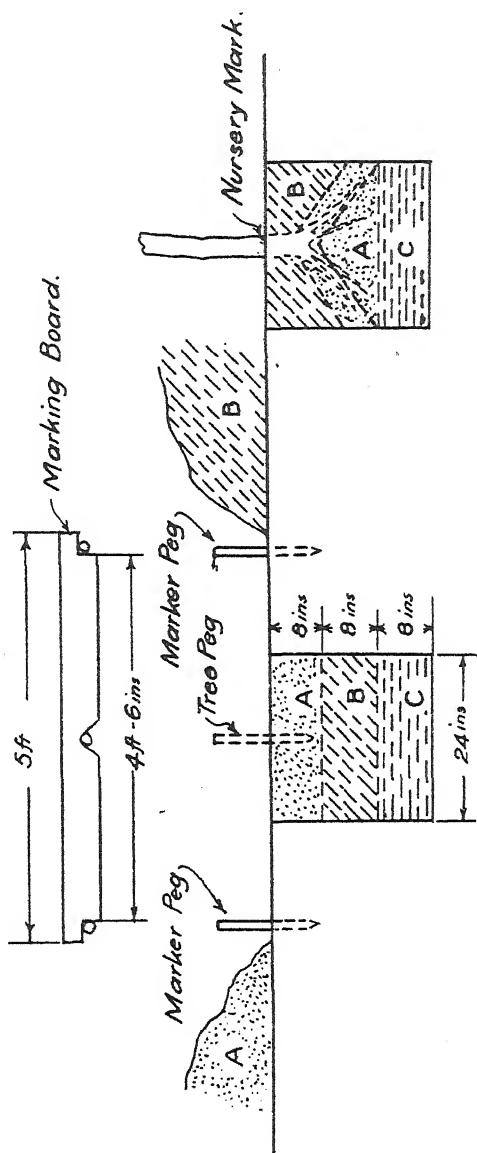
Preparation of Land.—After the selected site has been cleared of its timber, etc., it should be deeply ploughed and brought into good tilth; this is possible if performed towards the end of the rainy season—about March. When the ground

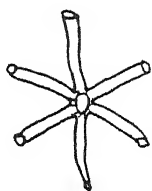
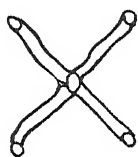
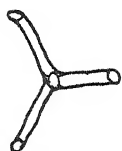
is prepared at this season most of the soil moisture will be conserved and the later operation of digging the holes will be made easier. When irrigation is possible it is also necessary to give careful attention to the problem of how the proposed site can best be irrigated. In such cases the advisability of grading the land before the trees are planted cannot be too strongly emphasised, as the efficiency of the irrigation scheme so much depends upon the proper grading of the site. After grading, the whole area should be re-ploughed, cultivated and brought into the best possible condition, and if it can be arranged a local irrigation should be given to ascertain which fall will be most suitable for planting the rows. The rows should preferably be short, with not more than 15 trees to each row. Such rows would be 120 yards in length and the fall should be about 6 inches per 100 feet, according to the nature of the soil; sandy soils require a greater fall than those of a medium or heavy character. When trees are planted on an ungraded soil continuous trouble will confront the grower, and as it is neither easy nor economical to grade the slopes of an established orchard, this work should be done prior to planting. The additional cost of a properly graded site is more than justified on account of the ease with which all of the cultural and irrigation operations may be performed. On ungraded slopes the trees will receive irregular supplies of water, and this in turn will necessitate more frequent irrigation. Depth of ploughing will also be uneven; silting will occur in the depressions, thereby endangering the health of many of the trees.

Laying out the Orchard.—After preparing the chosen site in a thorough manner it should be carefully laid out with the rows of trees planted along the contours, where necessary, allowance being made to permit of the irrigation water flowing evenly without displacement of the soil. The necessary appliances for the pegging out of the site are:—

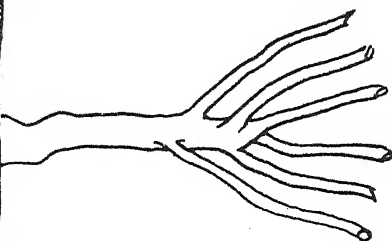
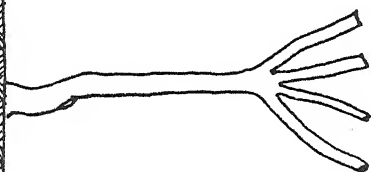
A planting wire or strong garden line to set about six pegs at a time (42 yards). For this purpose No. 16 galvanised wire could be used, and lumps of solder or rings of wire should be connected at the distances apart it is intended to space the trees. A 3-inch ring must be attached to each end

TREE PLANTING DIAGRAM





Spaced arms as seen from above



At planting

Well spaced arms

Badly spaced arms

*Six main arms
well spaced.*

Drawn in irrigation office

of the line 3 feet from the end solder mark. This facilitates the adjusting of the wire to its position when the pegging operation is proceeding. Two half-inch iron pins 18 inches in length will be suitable to hold the line in position while the marker pegs are being set. Sufficient wooden pegs 12 inches to 18 inches in length and about 1 inch in diameter should be available to allow three pegs for each tree to be planted.

The square system is the best for the laying out of the orchard, as it facilitates all cultural operations, chiefly on account of the wider middles (space between the rows of trees). It permits of ploughing and cultivation being carried out in four directions, and each tree has a greater root-feeding area than that obtained in other systems of planting.

The procedure to adopt when pegging the site is as follows:—Set the first line of pegs parallel but at least 60 feet distant from the windbreak, provided the fall is suitable for irrigation. When the base line is completely pegged the end lines should then be set at right angles to it and then pegged. The unpegged side should next be checked to ascertain if it is the same length as the base line, and if it is found to be incorrect it will then be necessary to adjust one end line to correct the error. The fourth side may then be pegged. We now have the site completely enclosed with the outer row pegs. Presuming that a six-peg wire is being used, it will then be necessary to peg every sixth line parallel to the base line; when this is completed the filling in will be simple. The line should be set between the base line and sixth row pegs and the four intervening pegs set. This filling in is then repeated until the end of the section is reached, after which the marking wire should be set from the sixth row to the eleventh row peg and the four intervening pegs set; this filling in process is then repeated until all pegs are set.

After the area is completely pegged, and if it is intended to dig the holes at once, the whole site must be doubly pegged to permit of digging the holes where the tree pegs stood. This pegging is simple if a suitable marking board is made as

illustrated in Fig. 1. The second pegging may be commenced from any corner of the site and can be continued row by row until completed.

Place the central notch of the marking board close against the tree peg, then set the two marker pegs in the end notches of the board, which may then be moved to the next peg, when the process is repeated until the site is completely double pegged. The tree pegs may be left standing, as they assist the hole-digger to locate the exact spot the tree is to occupy.

Digging the Holes.—All tree holes should be dug if possible several weeks before the planting of the trees is begun, and when this is possible the holes should be refilled with good soil soon after digging is completed to permit of the earth settling down, and thus eliminating the danger of the trees sinking too deeply, as is often the case where trees are planted immediately after the digging of the hole. The size of the holes for the trees should be at least 2 feet *square* (not round) and 2 feet deep.

The digger must first mark the size of the hole round the tree peg before withdrawing it. He should then dig out 8 inches of surface soil and place it on a site unoccupied by a marked peg. The second 8 inches of soil is then placed on the opposite side of the hole and the bottom 8 inches of soil is loosened and left in the hole. This procedure is best for soil of good depth and quality.

If the sub-soil is inferior to that of the surface soil the first 8 inches of soil should be placed as previously suggested and the remaining 16 inches be dug out from the hole and discarded, the hole being then two-thirds refilled with good surface soil collected from near by, the 8 inches of surface soil previously taken out being used to complete filling. When hard-pan is encountered it is advisable to break it with dynamite (agricultural). The explosion will shatter the hard-pan to a great depth and allow roots to penetrate in all directions. When dynamite is correctly used a pot-hole will be formed where the explosion took place; this hole should be closed and firmed, otherwise trees planted above it will gradually subside and eventually stand in a deep basin. This condition is very undesirable owing to water accumulating round the stem of the tree after irrigation or rain.

Planting Distances.—For best results most varieties of fruit trees should be spaced at certain specified distances. This is possible in commercial plantings, where large numbers of a fruit variety are planted. In the home orchard it is different, as often fruit trees that require various espacements must be planted in a small area. This difficulty may be overcome by arranging the varieties in such a manner that the short-lived trees may be rooted out when their neighbours or larger-growing trees require the additional space. Suitable distances for planting fruit trees are as follows:—

Variety.	Distance apart each way.
Pecan nut and walnut	48 ft.
Seedling orange and seedling Avocado pear, grafted orange, lemon, naartje, Tahiti lime, grape fruit, litchi, guava and pear	25 ft.
Almond, quince, West Indian lime, plum, peach, apple, apricot, nec- tarine, fig, cherry, custard apple, persimmon	20 ft.
Paw-paw, banana, plantain, tree tomato and Chinese guava	10 ft. to 12 ft.

It is not necessary or possible to plant the assortment stated, but it is often necessary to plant a mixture of trees requiring different espacement, which may be arranged as follows:—

N 12 ft.	T 12 ft.	S 12 ft.	T 12 ft.	N 12 ft.	T 12 ft.	S
T	T	T	T	T	T	T
S	T	S	T	S	T	S
T	T	T	T	T	T	T
N		C		N		C
C		C		C		C

N denotes Pecan nut trees ... 48 ft. apart.

S denotes Stone fruit trees ... 24 ft. apart.

C denotes Citrus trees ... 24 ft. apart.

T denotes Paw-paw trees ... 12 ft. apart.

The average profitable life of these trees would approximately be: Pecan nut 100 years, stone fruit 10 years, citrus fruits up to 30 years or over, paw-paws 5 years.

From the profitable ages given it will be seen that all the T's could be removed after the fifth year, thus giving additional space to the N's and S's. The S's would then be removed at the end of the tenth year to provide the N's with sufficient space to develop fully. This system of inter-planting short-lived trees between trees that grow to a large size and live to a great age is to be commended as the most satisfactory method for the lay-out of the home orchard.

Ordering of Trees.—When purchasing fruit trees for planting they should be ordered well in advance of the planting season. It is best to buy the trees from reputable nurserymen who raise good and healthy trees from selected parents. First-sized trees only should be used; smaller trees are often undesirable and seldom give good results.

Time of Planting.—Deciduous fruit trees should be planted when they are dormant (have shed their leaves), the best months being June and July: the latter month is somewhat late for many varieties of sub-tropical peaches, and these should, according to circumstances, be planted in June or even as early as May.

Citrus and other evergreen fruit trees may be planted at any season of the year, provided irrigation facilities are available and the trees are not in active growth. When only a few trees are to be put out, and assuming they are procurable, August is as good a month as any in which to plant. Given good attention and a full growing season, August-planted trees will out-grow those planted later in the year. For extensive plantings, however, the rainy season should be chosen, for then there is less danger of losses amongst the plantings. January is the best month if the trees are dormant. Trees planted this month will do better than those planted later, as they are more capable of withstanding any unfavourable climatic conditions which may occur during the following winter.

Choosing Varieties to Order.—For the home orchard it is advisable to select, as far as possible, varieties that are known to do well in the locality in which it is intended to plant. Well established nurserymen are often the best advisers in this respect, for they make a speciality of raising trees that do well in particular districts, their advice being based on repeat orders received from these areas.

Southern Rhodesia produces fruit ranging from temperate to tropical, for in the tropics high altitude gives large sections of country with a temperate climate. It is, however, advisable to plant most varieties that are known to thrive and yield fruit under sub-tropical conditions. It is also well to plant varieties to give, if possible, a sequence of fruit throughout the year. With the home orchard, owing to the greater variety of fruit trees planted, there is seldom the necessity to consider inter-pollination. When a few varieties of each fruit are planted, pollination is usually good. Fruits such as the Ohinemuri apple, Doyenne du Comice pear and most almonds are self-sterile, *i.e.*, they are incapable of pollination with their own pollen. Sometimes the male and female flowers mature at different periods and this prevents natural pollination. Walnuts also are often affected in this way. To counteract this difficulty the Ohinemuri apple tree must be planted next to the White Winter Pearmain apple. Comice pear next to the Beurre Bosc, and the Wickson plum next to Kelsey. This inter-pollination is to be considered more by the commercial planter than the home orchard, but even by the latter it should not be disregarded.

The commercial grower in the past often planted pure blocks of one or more of such varieties, with disastrous results. When these blocks of one variety were worked to two or more varieties blossoming at the same time, alternative rows having been cut down and top-worked, the trees started bearing as soon as the top-worked trees blossomed.

For the guidance of new growers, a list of suitable fruits is here given for the different elevations of Rhodesia:—

FRUIT VARIETIES FOR RHODESIA.

E—indicates Early Variety.

M—indicates Mid-Season Variety.

L—indicates Late Variety.

	Tropical Under 4000 ft.	Sub-Tropical 4—5000 ft.	Temperate. Over 5000 ft.
Apples	Rome Beauty ... L	Rome Beauty ... L Versfeld... .. L Carrington (Alma) E American Lady (Xmas)... .. E	Rome Beauty ... L Versfeld L Rhode Island Greening ... L Ohinemuri ... L Jonathan ... M Blenheim Orange Pippin M Cleopatra L
Pears		Keiffer Hybrid L le Comte M	Keiffer Hybrid L le Comte M Clapp's Favourite E Bon Chretien ... E Beurre Bosc ... M
Quinces		Cape Selected Meeche's Prolific Champion	Cape Selected. Meeche's Prolific. Champion.
Peaches	Killiecrankie ... E	Killiecrankie ... E	King Edward VII.
Y indicates yellow flesh.	Waldo E Angel M	Bell's November E Watt's Early ... E Jewel E Brook M.Y. Florida Gem ... M Florida Crawford M.Y.	Oklahoma Queen E Duke of York ... E Florida Crawford M.Y. Early Crawford M.Y. Mamie Foss ... M St. Helena ... L.Y.
Nectarines			Early Rivers ... E Gold Mine M
Plums—			
Red Flesh	Satsuma... .. M Santa Rosa E	Santa Rosa E Satsuma M Beauty E Wickson... .. M Kelsey L	Santa Rosa E Satsuma... .. M Beauty E Wickson... .. M Kelsey L Burbank... .. M
Pink Flesh			
Yellow Flesh ...			
Apricots		Alpha... .. E Early Cape E	Alpha E Early Cape E
Figs	White Genoa	White Genoa Adam	White Genoa Adam

	Tropical Under 4000 ft.	Sub-Tropical 4—5000 ft.	Temperate. Over 5000 ft.
Walnuts		Japanese	English
Pecan Nuts	Success Stuart	Success Stuart	Success Stuart
Almonds			Britz Jordon I.X.L. Paper Shell
Cherries			Belle of Orleans Napoleon Black Tartarian
Oranges	Washington Navel E Premier (Joppa) M Valencia Late ... L Seville (Marmalade)	Washington Navel Premier (Joppa) M Valencia Late ... L Seville (Marmalade)	
Grape Fruit	Triumph	Triumph	
Naartjes	Old Cape Emperor	Old Cape Emperor	
Lemons	Eureka Villa Franca	Eureka Villa Franca	
Lime	Tahiti	Tahiti	
Other Citrus (for preserves)	Kumquat Pompelmoes	Kumquat Pompelmoes	
Avocado Pears ...	Selected Seedling Budded Fuerte Budded Spinks Budded Gottfried Budded Dickey A.	Selected Seedling Fuerte Spinks Gottfried Dickey A.	
Mango	Selected Seedlings Kidney Peach	Selected Seedlings Kidney Peach	
Litchi	Layered Trees	Layered Trees	
Custard Apple ...	Seedling Cheri- moier	Seedling Cheri- moier	
Guavas	dwarf Strawberry Selected Seedlings	dwarf Strawberry Selected Seedlings	
Loquats	Selected Seedlings	Selected Seedlings	
Mulberry	Hick's Everbearing	Hick's Everbearing	English
Persimmon		Most varieties	

	Tropical Under 4000 ft.	Sub-Tropical 4—5000 ft.	Temperate. Over 5000 ft.
Banana	Ducasse Hybrid Custard Lady's Finger	Ducasse Hybrid Lady's Finger	
Grape Vines	Catawba	Catawba White Hanepoot Red Hanepoot Barbarossa Crystal	Catawba White Hanepoot Red Hanepoot Barbarossa Crystal
Other Fruits	Vumba Strawberry Tree Tomato Pineapple (Cayenne) Paw-Paw	Vumba Strawberry Tree Tomato Paw-Paw Raspberry (Red Cuthbert)	Vumba Strawberry Blackberry Raspberry (Red Cuthbert) Loganberry

Description of varieties will be found in nurserymen's catalogues.

Treatment of Trees on Arrival.—On arrival of the trees from the nursery they should be placed in a shady spot and kept moist until planted. They should not be left for any length of time in the boxes or sacking in which they were packed, but should be heeled into a trench and kept there until wanted. The heeling-in process consists of digging a trench about 18 ins. in depth, with one side sloping at an angle of about 45°. The trees are laid in not more than two or three deep, the soil being well worked around the roots and the trench then being filled with soil and watered occasionally to keep the trees in good order.

Trees received from a good distance sometimes arrive in a withered condition; these should be completely immersed in fresh water (running water if possible) for at least twelve hours or until the withered stems and branches regain turgidity. The revived trees may then be heeled-in as previously described, or planted if planting preparations have been completed.

Planting.—Before planting is commenced it is well to be sure that all the necessary appliances are at hand. These are: Marking board (previously used when double pegging), spade, sacking to protect the tree roots, secateurs (pruning shears) to



Desirable shelter of cupressus. An outer row of tall trees would furnish better results. These trees are too near the citrus trees.

trim the tree roots and tops, Bordeaux paste and brush to colour-wash the tree stems, and a sufficient supply of water to water the trees when planted.

Everything being in readiness, a few trees are then taken from the heeling-in trench, the roots being wrapped in damp sacking. Proceed to the first filled-in hole and have a small hole dug between the two pegs, then place the marker board end notches against the two pegs. Take a tree from the damp sacking and cut out the broken, twisted, damaged or diseased roots, and shorten back those that are too long. All cuts should be made diagonally on the under side of the roots. Care should be exercised that the roots are not at any time during the planting unduly exposed to sun or wind; cool and overcast days are best for planting, but these favourable conditions are not always to be had.

The stem of the tree is now placed in the central notch of the marker board, with the upper roots almost touching the planting board; the soil is then filled in slowly, the roots being evenly spread in all directions and well covered. Now remove the marker board and shake the tree slightly with an up and down action; this will assist the finer soil particles to collect round the roots and fill in the air spaces. A slight mound should be made over the roots at the base of the tree, after which the soil should be firmed by tramping it well over the roots and up to the stem. No fruit tree should be planted too deeply; plant no deeper than it stood in the nursery. This depth will be indicated by the nursery mark (junction of the yellow and brown or green bark of the stem near the roots).

It is an advantage to keep the nursery mark 2 ins. to 3 ins. above the normal soil level: the tree will then be well planted, and as the soil subsides the tree will gradually sink to the nursery mark level. If the upper roots of the newly-set tree are very close to the soil surface a small mound of loose soil may be placed over them; this will prevent any overheating or undue drying of the soil surrounding the shallow roots. The mound will gradually disappear with cultivation, but not before the tree is well rooted and no longer requires this additional protection. After planting, cut the tree back as illustrated for deciduous trees. Single stem trees may be headed back to the knee high for deciduous and 30 ins. for

citrus trees. Nursery shaped trees should have from three to four main arms retained for most deciduous fruits, with the exception of plum trees, which may have as many as six arms retained. The heading back of the tree will enable the reduced root system (lost when lifting in the nursery) to feed the proportionately reduced top in a normal manner.

Many fruit trees are planted without cutting back the tops; this is wrong, and causes an undue demand on the root system, of which over half was left in the nursery at the time of lifting. The larger the tree, the greater the loss of roots at the time of lifting. To counteract the loss of roots a proportional amount of the top must be cut away at planting. The trees should be watered as they are planted with at least eight gallons of water to each tree, and more if the soil is very dry. The watering will settle the soil and at the same time supply the tree with the necessary moisture with which to revive growth. When the surface of the soil is sufficiently dry after watering it may be lightly loosened again to check evaporation.

Protection from Sun-Scald.—It is advisable to protect the stems of all newly-planted trees from the hot sun; some growers use grass, but this is dangerous where ants are prevalent. The best temporary method of protection is to colour-wash the stems with Bordeaux mixture mixed to the consistency of thin cream.

A flat wooden slat of about 3 ins. in width is also useful for this purpose; it should be fixed on the western side of the tree stem. The sun's rays are then unable to shine directly on the tender stem and cause sun-scald. Attach the slat to the tree with string or spiral wire, care being exercised that the binder does not damage the bark of the tree by cutting into it. Trees damaged by sun-scald or those with a tendency to sun-scald should be slit through the bark from the ground level to the top of the main stem, also the main arms—always, however, on the western side; this allows the tree to develop. Naturally, unslit trees are apt to become bark-bound, which dwarfs the trees and affects their productiveness. They are also more susceptible to disease attack.

Where Fruit is Produced on Different Varieties.

Apple and Pear.—On spurs chiefly, also from terminal and lateral buds. Always on wood of the previous season's growth.

Quince.—From co-terminal buds on wood of the current season's growth.

Peach, Nectarine and Almond.—On wood of the previous season's growth.

Apricots and Plums.—Generally on fruit twigs and shoots produced during the previous season's growth.

Figs.—First crop, previous season's wood; second crop, on current season's wood.

Citrus.—On current season's growth; main crop of fruit on spring growth.

Walnut and Pecan Nut.—On current season's growth.

Mango and Loquat.—From terminal buds of previous season's growth.

Most other Tropical and Sub-tropical Fruits.—On wood of the current season's growth.

Grape Vines.—On new season's growth.

Most fruit buds are easily distinguished from leaf or shoot buds by their plumper appearance. With a moderate amount of experience it is possible to forecast the next fruit crop from the current season's fruit—bud formation.

When the bearing habits of the different kinds of fruit trees are understood it is possible for the fruit grower to regulate by pruning the bearing of each individual tree, and thereby overcome to a great extent the necessity for fruit-thinning after the crop has set.

Pruning.—The theory of pruning is based on certain observed facts, and the ultimate objects are:—

- (a) To produce a tree of a desirable shape.
- (b) To permit of economical cultural operations.
- (c) To reduce or stimulate the production of wood or fruit-bearing growth, as the circumstances require.
- (d) To remove injured, diseased or worn-out growths.

To accomplish these the farmer must take into consideration rules or laws which appear to almost invariably operate in the growth of plants; those of primary importance may be set out as follows:—

(1) The vigour of a tree is dependent upon its leaf surface.

Considering that the leaves are practically the lungs and stomach of the tree, this statement is tantamount to saying that the plant which has the largest transpiring and assimilating capacity must, when food is unlimited, be the strongest grower. This law has an important bearing on all pruning operations whilst the tree is in a state of vegetative activity.

(2) The nearer a shoot approaches a vertical position the stronger will be its growth. This is founded on an unvarying law of nature, by virtue of which the sap of plants flows more freely to the highest point of each shoot.

(3) The nearer a shoot approaches a horizontal position, so does its vigour diminish.

This is only a natural corollary to the previous statement. These two rules have a most important bearing upon the selection of shoots required for wood or fruit production. Vertical shoots usually run to wood above, while those tending towards a horizontal plane turn to fruitage. This goes to show that fruit bearing is an attribute of moderate weakness rather than of great vigour.

(4) The lesser the number of buds upon a branch the stronger will be the growth made by each individual shoot arising therefrom.

This may be put in other words, namely, that heavy pruning of the top tends to increase the production of strong wood growth. Under normal conditions of growth there is a balance between root and top. They mutually nourish each other, but when suddenly the top is reduced, without the inference of disease, the remaining buds make haste to utilise the extra volume of sap sent up to them. Partly for this reason, when pruning newly set trees, the number of buds is reduced by pruning away a large portion of the top shoots.

(5) If the root system be reduced the vigour of the top growth will be correspondingly diminished.

It is this fact which causes orchardists to prune the roots of rank growing unfruitful trees. Again, when young trees are removed from the nursery, many roots are cut off or so damaged as to necessitate their amputation. To counteract this the top growth must be curtailed, otherwise stunted development or death may result.

(6) When a number of shoots are growing at different levels upon the same tree, generally the topmost shoot absorbs most sap and outgrows those below.

This is seen in every tree, and gives rise to the practice of pinching the growing tips out of the highest shoots on young trees so as to lessen their natural advantage.

(7) Deformations of any kind, such as those produced by wounds or compression of sap vessels, diminish the activity of those parts situated above them.

The correctness of this statement is clearly shown in the effects produced by bruises, large wound scars, partial fractures, or the hardening of the bark caused by sun-scald.

(8) Within certain limits, the fruit production of any plant or tree diminishes with the increased development of its vegetative growth.

In other words, when a mature tree is forced into making vigorous growth, its production of fruit is lessened. Again, young trees, when properly nourished and trained, do not fruit freely until they have assumed considerable dimensions and have branches usually growing in a lateral direction, which make weak growth. This also points to the fact that the fruit-bearing habit arises from a quiescent condition in the plant or branch. To quote an extreme case, a super-abundant crop of oranges is usually regarded as a sign of the tree having begun to decline.

(9) The smaller the number of fruits the better their quality and size.

This is the chief reason why fruit growers thin their crops at an early stage of development. Pruning also is utilised to the same end. By judicious thinning out of the fruiting wood the possible number of fruits is lessened, and each one retained receives a larger share of the plant food elaborated.

The Seasons for Pruning.—Winter Pruning.—Winter pruning, which is practised when the wood has ripened and the leaves have fallen from deciduous trees, is most important. When the tree is devoid of foliage, the pruner can see the position of each branch and weigh its present use or calculate its future value.

The general effect of winter pruning is to stimulate vigorous growth when the growing season again begins. Winter pruning may be calculated to ensure wood growth for subsequent fruit crops rather than actual fruit production. It is of the greatest value in shaping young trees or renovating older trees which lack vigour.

The objects of winter pruning may be summarised as follows:—

1. To regulate the shape of young trees.
2. To ensure fruit wood formation on mature trees.
3. To regulate the fruit crop by the judicious cutting out of unnecessary fruiting wood.

Summer Pruning.—Summer pruning is the term used to define those operations which are performed upon a tree while in active growth. The objects are:—

- (a) To suppress all undesirable growths when they first appear.
- (b) To admit sufficient air and sunlight to the innermost branches, thus permitting them to mature naturally.

The suppression of all undesirable growths should be performed during the early part of the growing season. Other summer pruning is best performed in the latter half of summer or when there is no danger of the trees making new growth to replace the shoots taken out.

The Desirable Tree.—The ideal shape of a mature deciduous fruit tree is that of a goblet or wine glass, that is to say the tree has a straight short stem from which arise the main and secondary arms, while the centre is moderately open.

Proper Pruning.—First Year at Planting.—As previously stated, young trees should be headed back at planting time, knee high for unshaped deciduous trees and 30 inches for

citrus trees. When heading back at planting time, it is often found that a good framework has been produced in the nursery. If the branches arise on the main stem at the desired distance from the ground (18 inches deciduous, 30 inches citrus), select from three to six well spaced shoots arising from different points on the main stem and cut out the rest. The shoots retained should then be shortened back to about 9 inches in length or in proportion to their development (6 inches for weak to 12 inches for very strong). Three to four main arms are sufficient for most fruit trees. Plums with advantage may have up to six. The heading back of the main arms should be done in such a manner as to have all the cuts about level; if uneven, the highest one will outgrow the rest and produce a one-sided tree. When viewing a recently headed back tree from above, the cut surfaces of the three armed tree should form a triangle, if four a square, and if six a hexagon.

Summer Treatment.—The first growth that takes place after planting, if correctly treated, will soon form a well-shaped tree. Two shoots should not be allowed to develop from one spot. The weaker shoot should be rubbed off when still young and tender. If double shoots are allowed to develop from one spot on the main stem or main arms of a tree, they will form a Y crotch, which is objectionable owing to the likelihood of the crotch splitting with the weight of the fruit when the tree commences to bear.

All those shoots that have a tendency to cross or crowd each other should be suppressed. The energy required to produce these unnecessary shoots will then be deviated to the desired ones, which in turn will grow more vigorously. Shoots having a tendency to outgrow the rest should have their tips pinched back; this check generally has the desired effect of balancing the new growth. If the heads of the young trees are inclined to become too dense, it is advisable to thin out some of the growth. Air and light are essential for good healthy development. All shoots arising on the main stem should also be rubbed off as they appear; neglect in this respect will result in multi-stemmed and mis-shaped trees.

In training during the growing season the aim should be to encourage at least two good shoots to develop from each

main arm, one from either side. Trees with three main arms will then have six secondary arms, those with four will have eight, and so on.

Second Year's Winter Treatment.—If the trees have been well shaped during their first year's growth there is very little to be done during the second year's winter pruning when the leaves have fallen. All that is necessary is to cut any badly shaped, diseased or crowded shoots that may have been overlooked during the previous summer treatment. In trees with a natural spreading habit (apricot), the erect growing shoots should be retained for the secondary arms or leaders (see Fig. 5, parts of a tree, for explanation of these terms). With erect growing trees (Wickson plum), retain shoots to form the leaders from those with an outward growing tendency. Adopt long pruning for best results; this means the non-cutting or shortening back of the retained fruiting or other wood. All shoots that are not removed must be cut off close up to the limbs that form the framework of the tree; stubs are objectionable, as they may either produce an abundance of unnecessary growth or die back and so impair the health of the tree.

In all pruning operations care must be exercised not to injure the tree unnecessarily. Use good and sharp pruning tools, and see that all cuts exceeding $\frac{1}{2}$ inch in diameter are coated with a suitable oil paint; this prevents water from entering the wound, also decay.

Second Year's Summer Treatment.—This is similar to the summer treatment previously mentioned, comprising rubbing off all undesirable double growths, suckers and shoots that have a tendency to cross or crowd each other.

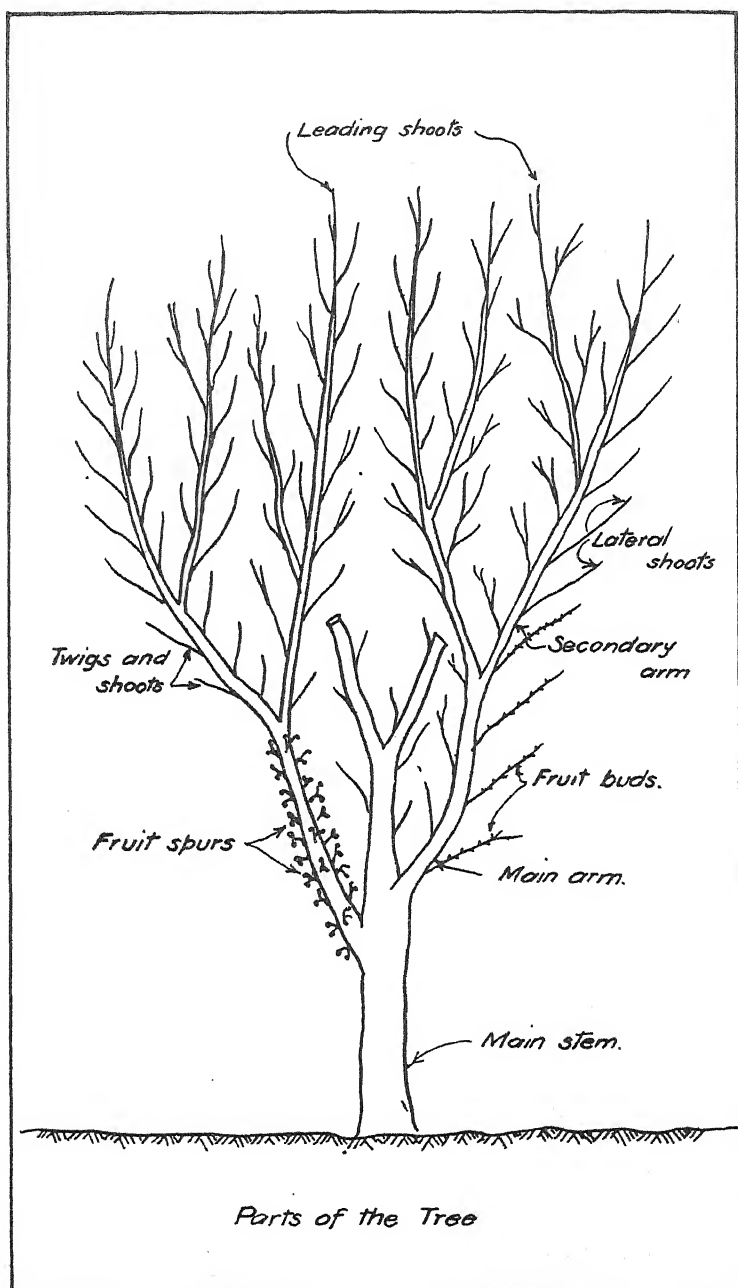
Early maturing varieties such as plums may have their strong lateral shoots broken back, but not detached, to about one-half their length. This breaking back should be done about January or sufficiently early in the growing season to enable the lower half of the treated shoot to form fruit-producing wood. This treatment, too, is recommended for large trees in vigorous growth. In many cases apple trees, if left to themselves, will have a tendency to produce one or more long shoots. When this occurs these shoots should be pinched back when about 9 inches in length to induce branching.



How to cut when heading back a tall Tree

1., A bad cut.

2., A good cut



Third and Subsequent Years' Treatment.—From now on the aim is to prune for fruit. If long pruning is adopted, summer pruning will be found to be of the greatest importance, as it will enable the grower to suppress at the correct time all unnecessary growths, and by the breaking of strong laterals induce good fruiting wood to form where it is wanted.

The winter treatment should then be confined to the cutting off of the broken points of the summer treated laterals, fruiting wood where crowded should be thinned, and leading shoots that grow too high should be shortened. When heading back a tall tree, select an outward growing lateral that arises some distance below the tip of the leader (see Fig. 6), and cut off just above the one selected. This system of heading back tall growing trees eliminates the possibility of a dense top growth occurring, as would be the case if other heading back methods were practised.

In a tropical climate and with the sun directly overhead in summer, it is not advisable to have the trees too open in the centre. To serve as a reasonable protection from sunburn, a few small branches should be left to develop from the secondary arms: these should grow inwardly, but should not be too dense. When deciduous fruit trees are left unpruned they have a tendency to bear heavy crops of small fruit every alternate season and little or no fruit in between. This is due to the trees being weakened through lack of proper care and nourishment, and they are consequently unable to mature a crop of fruit and fruiting wood for the succeeding year, as is done in healthy and well pruned trees.

Root Pruning.—Large fruit trees that bear no fruit but grow profusely should be root pruned; this will reduce the tree's vegetative activity and induce fruitfulness.

Root pruning is done by digging a trench round the tree, usually equal to the spread of the branches and about 2 to 3 feet deep. All roots that cross the trench are cut off, and the trench should then be refilled with the soil previously taken out. This treatment is generally effective, but this class of unfruitfulness must not be confused with that due to lack of inter-pollination.

Unprofitable Trees.—Many fruit trees on reaching maturity may be found to be unprofitable; the trees may either produce inferior fruit or poor crops. They should be rooted out or top-worked to suitable varieties.

Some fruit trees, if old, seldom give satisfactory results when top-worked, and should be replaced with young trees. Apple and pear trees may be top grafted to some known good variety. (For instructions on budding and top-working, see *Rhodesia Agricultural Journal*, October, 1923, or Bulletin 471.)

Trees Fruiting too Young.—Early fruiting should not be encouraged on young trees, as it is apt to dwarf or affect them to such an extent that they may be of little or no value in later years. It should be the aim of every owner to encourage top growth, and to achieve this all fruit must be stripped from the trees as it sets, thereby enabling them to utilise all of their energy for the development of the frame and fruiting wood of the tree.

No hard and fast rule may be laid down for the age at which trees should bear their first crop of fruit; this is dependent on many factors, but for the guidance of those unaccustomed to working with fruit trees it may be as well to give the average bearing age of a few of the more important fruits. These are:—

Citrus Fruits.—These often set a small crop of fruit within a year of planting, but they should not be permitted to bear before the third season, and in some cases, when the tree has made a poor growth, not before the fifth season.

Stone Fruits (Peach, Plum, Apricot, Almond, Nectarine, etc.).—If the trees make good growth during the first season they may be permitted to carry a little fruit during the second year. The third year, however, is the correct time for them to commence fruiting.

Pomaceous Fruits (Pear, Apple, Quince, etc.).—A very wide range of bearing ages is to be found in this group. Some varieties may commence bearing the second or third year after planting: others not for ten or more years. A fair average may then be taken at five years, but on no account

should any trees in this group be permitted to bear before the third season, and then only one or two specimen fruits per tree.

Other Fruits.—Guava and paw-paw, second year; fig, mulberry, custard apple and mango, third year: avocado pear (seedling), seventh to tenth year, budded third to fifth year.

Fruit Thinning.—Many fruit trees, although well pruned and cared for, may have a tendency to produce more fruit than they are capable of maturing, the resultant crop often being very small and unsuitable for the home requirements.

All trees should be examined a few weeks after blossoming, and those that set too heavy a crop should have the fruit thinned out to enable the tree to safely carry the load and at the same time produce good sized fruit.

By thinning a fruit crop it is often found that it is possible to produce an equal weight of good large fruit from a tree that has been correctly thinned as would have been the case had the whole crop of fruit been retained. To obtain the best results fruit thinning should be carried out when the fruit is still small, as late thinning is unsatisfactory. Every owner must use his own discretion when thinning fruit, as he will be the only one capable of gauging the fruit-carrying capabilities of his trees.

To assist those undertaking this operation for the first time it may be advisable to lay down a few rules to be observed in thinning, namely:—

- (a) When fruit is borne in clusters it is advisable in most cases to reduce the clusters to three fruits.
- (b) Fruits borne along the entire length of lateral shoots: these should be thinned down to one to four fruits, or in accordance with the vigour of the shoot.

Harvesting and Storing.—All fruit should be carefully gathered and placed in padded baskets or boxes. It should be handled much in the same way as eggs, for all bruised fruit will have its keeping quality impaired. A ladder should be used when necessary; do not pull the branches down so they may be broken, and if this happens the shape of the tree may be ruined. Many years' work is necessary to re-shape broken trees.

Some fruits ripen better when stored in the house or store. These varieties if left to ripen on the tree produce fruit of an inferior quality, mealy and unpalatable. Wickson plums and most apples and pears must be gathered before ripe if the best flavoured fruit is wanted. When harvesting pomaceous fruits such as pears, apples, etc., it is extremely important that the fruit be neither too green nor too ripe, but there are a few exceptions to this rule. An excellent test, although not always dependable, to ascertain the correct stage for harvesting the pear in particular is one in which the fully developed fruit is gently lifted upward. If the fruit stalk detaches from the twig or shoot easily, the fruit is ready to harvest. A safer test for the amateur is one where the fruit is cut through the centre horizontally to expose the seed cavities. If the seed is commencing to turn brown the fruit is fit to harvest. But some apple and pear varieties may be found to have brown seeds before the fruit is quite fit to harvest, and here a little experience in picking is necessary.

When harvesting fruit the picker must always aim at the retention of the stem or stalk. Fruit from which the stalk has become detached will decay or wilt more readily, and the keeping properties are considerably impaired. Fruit that does not detach easily must be clipped in the same manner as is done when harvesting citrus fruits.

Harvesting should continue from time to time as the fruit sizes up and is at the correct stage of ripeness. It may sometimes be necessary to pick over a tree several times. Harvesting should take place when possible during the cool period of the day. If carefully handled at harvesting, many varieties of fruits may be stored for several weeks. The fruit may be spread out on shelves or packed in single layers in clean boxes. These may then be stacked one on the other. When storage is contemplated it is as well first to test the keeping qualities as the different varieties ripen, and to do this it is advisable to pick a little fruit at different stages of ripeness. This will soon furnish the desired information regarding keeping quality and the best stage of ripeness at which to harvest. Immature fruit will generally shrivel and over-ripe fruit become mealy. The correct stage will give good coloured and well flavoured fruit.

Irrigation.—If water is available, trees should never be allowed to suffer for want of it. All trees require water in early spring before blossoming, and citrus trees again when in full blossom.

Irrigate whenever the soil lacks moisture or when the tree leaves are inclined to feel limp (not turgid) when felt in the early morning.

The absence of sufficient moisture soon affects the turgidity of the leaf and is easily detected about breakfast time. If trees have sufficient moisture the leaves will be crisp. Too much water is just as harmful as too little; trees so treated are more susceptible to disease, fruit is inferior in quality and lacks keeping qualities. Never allow water to come in direct contact with the stems of trees nor apply cold water to fruit trees such as the fig when the soil is hot. This may cause shedding of the immature fruit.

Small and frequent applications of water should not be given; this induces shallow rooting, while most of the added moisture is lost by evaporation. Rather supply water in much larger quantities and at intervals of one month to six weeks, and loosening the surface soil after the water has soaked away.

Manuring.—All fruit trees should be manured and fertilised from the time they start bearing fruit. Farmyard or kraal manure is the best, for it not only supplies necessary plant foods, but a large amount of humus. This organic matter improves the physical condition of the soil, and is in every way desirable. Necessary soil bacteria are able to increase and liberate other plant foods. If manure is unavailable, green crops must be planted, and these, when grown, should be ploughed or dug in. Leguminous crops, such as beans, peas, sunn hemp, etc., are best; they absorb nitrogen from the air and fix it in the soil through the agency of bacteria present on their roots.

All weeds that are cut out from time to time should be saved, and at the end of the rainy season spread out and ploughed in along with the green crop. In addition to green cropping, artificial fertilisers are sometimes advisable, the quantity to apply varying with the nature and fertility of the soil. There is also the age or variety of tree to consider.

Complete fertilisers are as a rule the best, for they contain all the essential plant foods. As a basis to work on, well grown fruit trees should receive 100 lbs. of kraal manure per tree per annum; also a complete commercial fertiliser containing 12 per cent. phosphoric oxide, 6 per cent. nitrogen and 8 per cent. potash. This commercial fertiliser, known as fruit and citrus fertiliser, may be applied at the rate of 1 lb. for each year of tree's age, with a maximum of about 10 lbs. for deciduous and 15 lbs. for full grown citrus and other evergreen fruit trees.

The most convenient time to apply the manure and fertiliser is at the end of the rainy season or when the soil is in good condition for ploughing it in. All manures and fertilisers should be broadcast between the trees (not under them). This applies to well grown trees which have their root systems well distributed throughout the soil. For young trees the applications may be made nearer the trees, but not nearer than one foot from their stems.

Cultivation.—All work connected with fruit growing must be carried out systematically, and a definite programme should be laid down and rigidly adhered to. Every detail of working is an important item and must be attended to at the correct season. There is a right time for all orchard work, and if this opportunity is once missed it is liable to be reflected in the next season's crop, and even for longer periods.

It is, unfortunately, a not infrequent occurrence for the orchardist to defer working up the land immediately after the rains have ceased. Thus when the delayed work is eventually carried out a good tilth is not obtained. Incalculable harm may be done to fruit trees by delaying the autumn digging or ploughing until so late that the ground has become too dry for effective tillage, and much of the soil moisture has been lost. On the heavier soils, too, the earth breaks up into huge clods, and it may then take more than a whole season to bring back a good tilth to the orchard.

Instances could be quoted where such delays have occurred in cultural operations, with the result that the crops of fruit then maturing were impaired, and the crops set a few months later were greatly reduced. Delay in carrying out

the necessary cultural operations usually spells loss of crop, and these remarks apply not only to cultivation, but to all other phases of orchard work.

Cultivation is beneficial and necessary in many ways to the general health of an orchard. It pulverises the earth and allows aeration of the soil, and the water retaining capacity of the land is increased. Rain more readily penetrates to the deepest layers, and evaporation is checked by the reasonably fine top mulch produced by good tillage.

In Rhodesia we must always be prepared for a possible shortage of rain, quite apart from the certainty of a period of six or seven months when no appreciable rainfall can be expected, and our system of cultivation must be adapted accordingly.

Before the wet season arrives the orchard should be thoroughly cultivated so as to be in a condition to receive the greatest possible benefit from the rains that may fall. When the cultivation is completed, and after the first good rains have fallen, it is advisable to sow a cover crop of sunn hemp or some kind of bush bean over the whole area between the trees. When the cover crop has attained its maximum growth, and if the rainy season is drawing to a close, or if the orchard soil is not too wet to plough, the crop should be turned under by ploughing first in one direction between the rows with a mouldboard plough to a depth of from five to six inches, and then when the turned under cover crop is sufficiently decomposed and it is not likely to be dragged out of the soil again, the grove should be cross ploughed, this time to a depth of about eight inches. By setting the plough at the greater depth when cross ploughing no vegetable matter will be left on the surface of the soil.

When the ploughing and cross ploughing have been thoroughly done, the soil should be well harrowed in both directions.

The unploughed soil under the trees should also be dug over at this season of the year, when all the weed growth and fallen leaves will be turned under. An ordinary digging spade is best for this work, as the hoe or fork is more likely to damage roots.

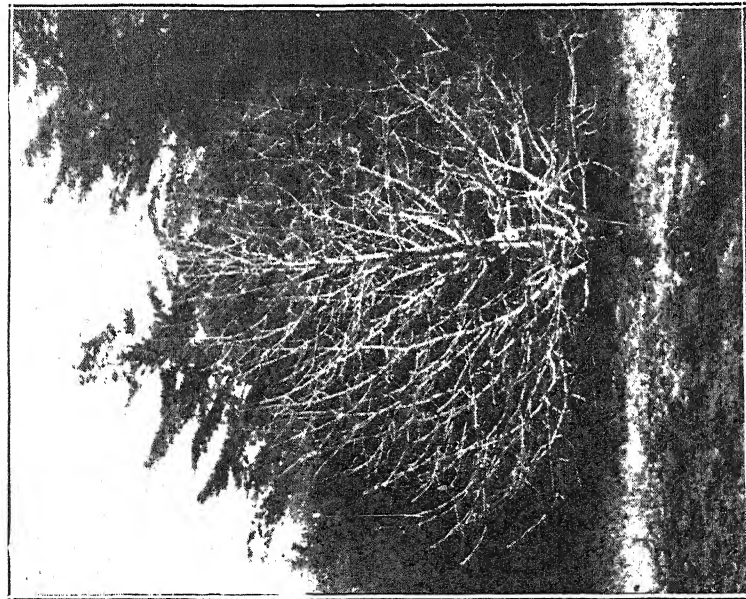
When the entire orchard has been worked by ploughing and digging it should secure fairly frequent cultivation, the period between these cultivations not usually exceeding one month. Cultivation is also necessary when the soil is sufficiently dry after each irrigation.

Inter-cropping.—Under some circumstances young orchards may be successfully inter-cropped, but this should not be attempted unless proper cultivation can be given and manure can be liberally applied. Inter-cropping enables the man with limited capital to overcome the initial expenses of cultivation and incidentally leads to regular cultivation between the trees. Tall growing plants such as maize should be avoided, and the inter-crops should be restricted to such as peas, beans, tomatoes, potatoes, etc., whichever suit the conditions best and are likely to be the most profitable.

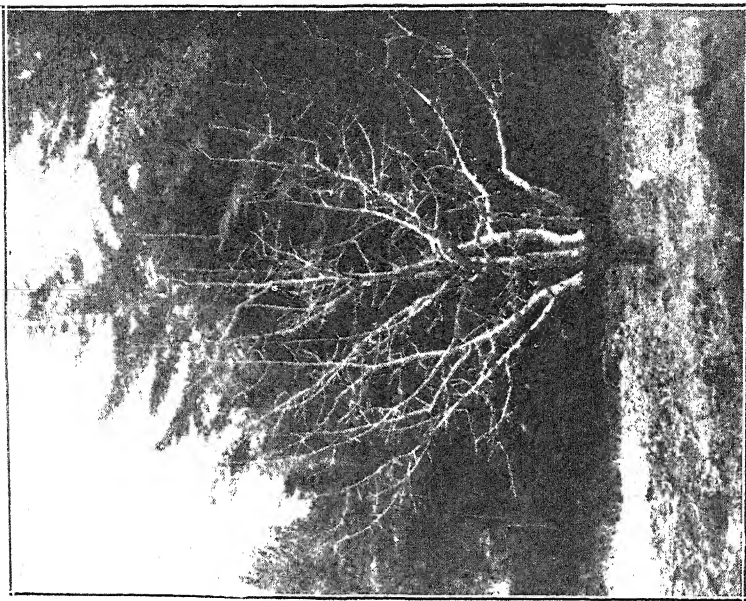
Where no irrigation is practised inter-planting should only be confined to the rainy season, and then only to such crops as will mature before the approach of the dry season.

Diseases.—When considering the question of diseases, adopt the principle that prevention is preferable to attempted cure; most diseases are preventable, few curable. Many home orchards are neglected from the time disease and pests first make their appearance. This would not be the case if growers when establishing their orchards would look upon spraying as one of the essential cultural operations. Many trees planted by the pioneers did well for a time, but when disease made its appearance they were abandoned.

To maintain fruit trees in good and healthy condition, make a practice of spraying annually with a fungicide. Spray in winter before the trees start growth. A good spray for this season of the year is lime sulphur mixed according to the directions on the container. Proprietary lime-sulphur is recommended; home-made solutions take time and are so often incorrectly made. This winter spray acts as a tonic to the tree; it is also an insecticide as well as a fungicide. Bordeaux mixture is also a good spray for winter or summer use. It is a fungicide purely and simply. Use the formula 4.4.50, that is 4 lbs. bluestone (CuSO_4), 4 lbs. quicklime (CaO) and 50 gallons of water. For tender plants use half strength—



Old and neglected pear tree before pruning.



Same tree after pruning.

4.4.100. This spray may be used for any disease control. The novice is recommended to use the proprietary prepared Bordeaux. It is usually bought in small quantities from stores stocking horticultural supplies.

In preparing home-made Bordeaux mixture, quicklime of good quality is best. If the calcium oxide content is low more lime must be used.

Stock Solution.—Dissolve 4 lbs. bluestone (CuSO_4) in 4 gallons of water. Use a wooden or earthenware vessel. Metal containers must not be used, for they will corrode and the spray may be spoiled. Next take 4 lbs. quicklime and slake. This is done by adding water gradually to the lime until the burnt lime breaks down and forms a fine powder. When water is added to the lime a chemical change takes place: heat is generated during the process, and if water is added in moderation the slaked lime will become a fine white powder. This slaked lime is next added to 4 gallons of water and stirred well. We now have two stock solutions containing 1 lb. of lime or bluestone to the gallon of water. To make up the mixture on a small scale procure a wooden barrel and add $10\frac{1}{2}$ gallons of water; next take 1 gallon each of the stock solutions and pour simultaneously into the barrel containing water. If free bluestone (CuSO_4) is in the mixture it is dangerous to apply it to trees in foliage.

Test.—Dip the blade of a clean knife into the mixture after well mixing it, and after a minute's immersion if the blade shows a copper coating more lime water must be added to neutralise the excessive bluestone (CuSO_4).

Agitate the mixture when spraying. Stock solutions will keep for a considerable time if covered and protected from the air.

Hardy deciduous trees may be sprayed in winter with a solution of 1 lb. bluestone to 25 gallons of water. This is very effective in preventing disease and lichen growth. *It must not be used on foliage or tender plants, for they will be killed.*

Insect Pests.—A knowledge of the feeding habits of insects is essential if pests are to be controlled and good sound fruit grown. A simple classification is as under:—

1. Chewing insects.
2. Sucking insects.

When spraying to combat the ravages of chewing insects a poison mixture must be used that will not damage the fruit or foliage. The best spray is arsenate of lead, $1\frac{1}{2}$ lbs. to 50 gallons of water. The spray must be well atomised so that a fine film of poison is left on fruit and foliage when the trees dry after being sprayed. Chewing insects attacking the sprayed trees are poisoned before they do damage. It is sometimes necessary to spray several times, especially when insect pests produce more than one generation during the season. All fruit and foliage chewing insects may be controlled with this spray.

Sucking insects are divided into two distinct classes:—

- (a) Those sucking food from the surface of fruit or foliage.
- (b) Those sucking food from inner tissues of fruit or foliage.

Surface sucking insects (fruit fly, house fly) are best controlled by baiting attacked plants with a sweetened poison. This must be sprayed on to the foliage of the treated plants or trees in small drops. Use the ordinary garden syringe for applying; keep the mixture off the fruit as much as possible. Try to get bait in the shady part of the trees where the fly rests during the day. This treatment will kill most of the mother flies before they lay eggs. Treatment is started about three weeks before fruit ripens, and is continued to the end of the season; in dry weather about every ten days, in wet weather when foliage is dry after each rain. The mixture is poisonous to human beings and animals, and must be kept under lock and key. It is made up as under:—

2 ozs. arsenate of lead, powder.

$\frac{1}{3}$ gal. treacle, or $2\frac{1}{2}$ lbs. cheap sugar.

4 gals. water.

Dissolve sweetening matter in a little water, mix arsenate of lead, then add full quantity of water. Keep agitated while spraying.

Insects sucking their food from the inner tissues, such as scale of all varieties, must be sprayed or fumigated. The latter method is most effective, but not always possible owing to the cost of necessary equipment. The object in view when treating this class of insect is to burn or suffocate it. Resin wash is one of the best sprays for this work. If the trees are well and evenly sprayed the insects will have a complete film form over them. This when dry will exclude air from their breathing pores and they then die and fall off. Resin wash may be purchased from most firms stocking horticultural appliances, or it may be made up as follows:—

24 lbs. cheap resin (or $2\frac{1}{2}$ lbs.);

5 lbs. caustic soda (or $\frac{1}{2}$ lb.);

$2\frac{1}{2}$ pints fish or cotton seed oil (or $\frac{1}{4}$ pint);

100 gals. water (or 10 gals.).

Heat 15 gallons water to about 150 deg. F., then add the caustic soda slowly and next the oil. When the mixture starts boiling add the resin gradually; keep adding water to prevent boiling over, and boil for about half an hour after all resin has been added. The mixture should have no lumps of resin in it, and the colour should be that of very strong tea. The added water should bring the quantity of concentrated spray up to 25 gallons; dilute to 100 gallons or 1 to 3 of water, and to obtain the best results spray when warm (not hot). Resin should be well powdered before adding to the boiling mixture.

Pests affecting the roots of plants are more difficult to control. These include nematodes, worms, woolly aphis on apple roots, etc. Soil fumigants are best for treating this class of pest; tobacco dust is good if worked into the soil round the trees. Vaporite is also used for this purpose: the latter is usually stocked by wholesale chemists.

General precautions must be taken against pests and diseases. Collect all visibly affected fruits and destroy them. Never leave fallen fruit on the ground for any length of

time. Boil or bury them very deeply. Such measures have a marked and beneficial influence on the control of all pests. Hand collecting of some of the insect pests is necessary if they are to be checked or destroyed.

SUMMARY.

1. The best orchard soil is a light to medium light loam with good depth and drainage.

2. All orchards should be sheltered either naturally or artificially from the hot and dry winds experienced during the Rhodesian spring.

3. The best aspect for the orchard is a gentle southern and eastern slope.

4. Preference should be given to a site capable of being irrigated.

5. The site should be near the homestead.

6. The land should be well prepared and graded before planting.

7. All holes should be dug two feet square and 2 feet deep, then be filled with good surface soil.

8. Trees should be planted at the correct spacing, if necessary so arranged that short-lived trees may at a later date be taken out to furnish more growing room for longer lived larger trees.

9. Trees should be ordered well in advance of the planting season; this ensures securing the desired varieties.

10. Deciduous trees must be planted in June and July, citrus and evergreen trees generally early in the rainy season.

11. Buy first size healthy trees from an established nurseryman.

12. Choose varieties suitable for the zone you wish to plant them in. Cherries will not grow at Mazoe, nor will paw-paws grow at Inyanga Hotel.

13. If trees are dry and shrivelled on receipt, treat them as directed.

14. Plant trees no deeper than they stood in the nursery; deep planting is fatal to most trees.

15. Certain varieties must be planted side by side for inter-pollination purposes. Bordeaux wash, or affix wooden slats on the western side of the stems of young trees; this prevents sun-scald.

16. Pruning is essential with most deciduous fruit trees. In order to regulate the crops the owner must understand the fruit-bearing habits of the trees to be pruned. Vigorous trees require light pruning and weak trees heavy pruning.

17. Winter pruning should be performed when the trees have shed their leaves. Summer pruning is done during the growing season.

18. All deciduous trees should be shaped like a goblet or wine glass. This allows air and light to penetrate to the inner branches. In Rhodesia the trees must not, however, be kept too open in the centre.

19. All dead, weak and diseased wood must be cut out; also branches that cross or crowd each other.

20. All unprofitable trees should be replaced with good varieties either by re-planting or top-working.

21. It is a mistake to allow trees to fruit too young; this causes dwarfing, and they are of little value in later years.

22. The fruit should be thinned out of all trees that have a tendency to over-produce; 100 good large fruits are better than 500 small ones.

23. Fruit thinning must be done soon after the fruit has set; late thinning is useless.

24. When harvesting fruit, handle it as you would eggs.

25. Use a ladder on large trees; other methods end in broken limbs of trees or pickers.

26. Over-ripe fruit is often unpalatable; harvest all fruit at the correct stage of ripeness. Many late apples, pears and other fruits may be stored for several weeks.

27. All trees should be watered when they are in need of it; fruit crops will fail if the soil is dry when the trees are in blossom. When possible, irrigate all fruit trees before they blossom, and citrus trees again when in full flower.

28. Fruit trees are incapable of producing annual crops of good fruit without being fed. They should be fertilised and manured from the time they commence to bear. Large trees require more feeding than small ones.

29. Early autumn is a good time to feed trees, as the food may then be ploughed under with a green crop.

30. Sunn hemp is the best green crop to grow between the trees, for ploughing it under furnishes a large amount of humus-forming material, which is particularly valuable if farmyard manure is not available.

31. Good cultivation is essential for successful fruit growing. Plough the ground in autumn, loosen the soil under the trees and harrow occasionally to produce a good tilth and conserve the soil moisture.

32. Cultivation enables the roots to receive sufficient air, which is so necessary for their healthy development.

33. Inter-planting of young orchards may be practised. Tall growing crops are unsuitable, since they exclude air and light from the young trees. Do not inter-plant large trees; they require all the air, space and plant food available.

34. Spray in winter with lime sulphur; this prevents disease and destroys pests.

35. Leaf and fruit chewing insects may be killed by spraying their food supplies with poison.

36. Sucking insects are destroyed by poison baits or a caustic contact spray.

37. Most spray mixtures are poisonous things. They should be kept under lock and key, and be handled with great care.

38. The Government Horticulturist is employed by the State to give advice on fruit culture. Make use of him.

Southern Rhodesia Veterinary Report.

APRIL, 1935.

AFRICAN COAST FEVER.

Charter District.—Eighteen cases occurred in the Greyling Centre, as heavy mortality occurred on the farm Steinbuck; the herd is being slaughtered off. There were no cases at the Riversdale Centre.

Salisbury District.—The infected herd on Nyaringondo Farm was destroyed.

FOOT AND MOUTH DISEASE.

Salisbury District.—The infection spread to two areas.

Victoria District.—There was a spread of infection in the Chibi district.

Gwelo District.—The Selukwe Native Reserve and several farms adjoining became infected.

TRYPANOSOMIASIS.

Two cases in Melsetter district, two in Gatooma district and two in the Lomangundi district.

HORSE-SICKNESS.

One case in the Gwelo district and two in the Salisbury district.

TUBERCULOSIS.

Two cases diagnosed in Salisbury.

SCAB.

Four native flocks were placed in quarantine in Melsetter district.

TUBERCULIN TEST.

Six animals were tested on importation with negative results.

MALLEIN TEST.

Ninety-seven equines were tested upon entry; no reactions.

IMPORTATIONS.

From the Union of South Africa and Bechuanaland Protectorate:—Cows 3, calves 2, bulls 1, horses 36, mules 44, donkeys 17, sheep 1,146, goats 242.

EXPORTATIONS.

Three hundred and forty-three sheep.

EXPORTATIONS.—MISCELLANEOUS.

To the United Kingdom *via* Union Ports in Cold Storage:—Chilled beef quarters, 9,751; frozen boned beef quarters, 7,422; frozen boned veal quarters, 236; tongues, 12,589 lbs.; livers, 24,514 lbs.; hearts, 10,221 lbs.; tails, 7,134 lbs.; skirts, 4,512 lbs.; shanks, 22,458 lbs.; kidneys, 2,474 lbs.; glands, 177 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 33,785 lbs.; meat meal, 85,000 lbs.; beef powder, 67,459 lbs.; beef fat, 96,000 lbs.; tongues, 1,440 lbs.; corned beef, 43,200 lbs.

From Rhodesian Export & Cold Storage Company: Beef fat, 36,219 lbs.; casings, 46 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 30, May, 1935.

Red Locust (*Nomadacris septemfasciata*, Serv.).—A few swarms of the Red Locust have been reported in different parts of the Colony during the month, but most of these are stated to have been of large size.

Swarms which probably originated in Portuguese East Africa have been haunting the region of the Eastern Border in the southern uplands of the Melssetter district, penetrating at times as far west as the Sabi River Valley. Other districts involved include Lomagundi, Inyanga, Marandellas, Gwanda, Mazoe, Darwin, Hartley and Chibi.

No reports of disease amongst locusts have been received and swarms examined personally in the Melssetter district appeared to be quite healthy, in spite of unusually humid weather for the time of year.

A small band of hoppers was reported in the Lomagundi district as late as the 3rd.

The position generally is, therefore, comparatively quiet but, if favourable weather conditions occur next spring, there are obviously sufficient numbers of the Red Locust in the swarm phase in this Colony and adjacent territory to initiate another period of increase, and the outlook at present must be regarded as uncertain.

Brown Locust (*Locusta pardalina*).—Several reports have described the locust swarms seen as "brown," but no specimens so described have been received at headquarters. The districts in reference have also been remote from the Western border, and it appears improbable that any swarms of the real Brown Locust have as yet invaded the Colony.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

MAY, 1935.

Pressure.—Mean pressures for the month was below normal.

Temperature.—The month was notable for its unusually rapid fall off in temperature, very low readings being recorded towards the end. The monthly mean was therefore below normal throughout the Colony.

Rainfall.—Despite the cool weather, good showers of rain fell fairly generally, except in the extreme south, during the first four days of the month, some stations receiving over an inch. On the 14th and 15th further scattered showers occurred; the rest of the month being dry.

MAY 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.							Ins.				Nor- mal	No. of Days		
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.									
Angus Ranch...	...	...	90	39	78.0	52.8	65.4	65.4	61.8	56.1	70	0.27	0.19	4	...	1,500	
Belt Bridge...	968.0	...	94	46	81.1	53.2	67.2	...	64.1	55.6	58	0.17	0.44	4	2.5	3,700			
Bindura...	894.2	...	84	42	77.3	50.6	63.9	...	62.7	55.6	63	0.48	0.57	1	1.4	4,426			
Bulawayo...	870.9	872.0	87	35	74.2	47.3	60.7	61.1	59.8	51.3	56	2.7	0.46	0.35	2.7	3,685			
Chipinga...	894.8	...	82	39	71.6	52.5	62.1	...	62.9	56.6	69	2.34	0.97	7	4.788	3,571			
Enkeldoorn...	860.1	...	83	36	72.3	48.3	60.3	60.9	59.1	52.7	65	2.2	0.34	0.33	4	3,278			
Fort Victoria...	...	...	...	...	...	...	...	...	...	...	...	...	0.28	0.00	2	3,229
Gwaai Siding...	906.9	...	92	33	81.5	45.9	63.7	...	60.4	52.4	58	2.3	0.21	0.30	2	4,629			
Gwanda...	908.7	...	91	38	76.2	49.7	62.9	...	58.6	51.4	61	46	0.71	0.32	2	3,879			
Gwelo...	864.8	...	84	35	72.8	47.0	59.9	60.8	58.2	52.0	61	47	0.37	0.32	2	5,514			
Hartley...	887.9	...	85	36	78.0	47.0	62.5	63.4	60.5	53.9	65	48	0.82	0.59	3	5,453			
Inyanga...	838.8	...	...	...	...	...	...	...	...	...	...	...	1.18	0.64	5	4,090
Marandellas...	839.6	...	77	38	69.0	48.8	58.9	...	57.3	51.4	67	47	0.04	0.03	1	3,179			
Miami...	881.2	...	82	42	76.2	51.2	63.7	...	64.4	56.6	61	51	0.14	0.51	3	6,668			
Mount Darwin...	910.2	...	88	38	79.6	48.8	64.3	...	65.1	58.1	65	53	4.4	1.10	...	4,141			
Mount Ntaza...	...	...	71	34	59.5	46.0	52.8	...	52.2	47.5	74	43	1.8	0.56	3	2,690	
Mtoko...	879.9	...	83	43	76.0	52.7	64.4	...	64.0	56.8	64	52	0.53	0.37	3	1,581			
New Year's Gift...	90	43	78.4	51.1	64.8	...	61.4	56.7	75	53	...	0.53	0.53	3	4,549		
Nuanetsi...	965.8	...	95	34	81.2	49.6	65.4	...	64.8	56.8	61	52	3.8	0.36	0.33	3	3,999		
Pumtree...	866.5	...	89	37	74.2	50.3	62.3	...	60.7	52.3	56	45	1.2	0.19	0.69	3	4,885		
Que Que...	884.4	...	86	39	75.9	47.7	61.8	...	60.7	53.5	62	48	2.0	0.71	0.22	1	3,193		
Rusape...	864.7	...	83	32	71.6	46.4	59.0	...	57.7	53.3	75	50	2.3	0.70	0.27	1	4,648		
Salisbury...	857.0	857.8	81	36	73.6	48.2	60.9	61.0	61.1	53.9	62	48	1.1	1.41	0.46	4	3,795		
Shabani...	910.8	...	91	43	76.8	52.9	64.9	...	60.6	53.7	64	48	3.1	0.36	0.54	5	3,193		
Sinoia...	891.0	...	87	36	79.4	45.6	62.5	...	62.3	55.4	64	50	0.9	0.00	0.35	...	3,795		
Spillio...	887.5	...	82	44	76.1	52.3	64.2	...	64.9	56.7	60	52	0.7	0.50	0.38	2	3,876		
Stapleford...	844.2	...	76	30	65.0	40.1	52.6	...	54.1	51.4	84	49	3.5	1.66	1.26	5	5,304		
Umtali...	895.6	896.5	83	41	74.1	51.1	62.6	62.6	61.5	56.6	74	53	4.0	0.49	0.49	3	3,672		
Victoria Falls...	96	40	86.4	48.5	67.5	...	63.5	55.0	48	48	0.5	0.00	0.43	...	2,990		
Wankie...	929.9	...	95	47	84.9	57.7	71.3	...	66.1	55.8	51	48	0.6	1.52	0.81	3	2,567		

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
- No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
- No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
- No. 634. Barley, by P. V. Samuels.
- No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
- No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
- No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
- No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
- No. 681. The Sunflower (*Helianthus Annuus*) (Revised), by S. D. Timson, M.C., Dip.Agric.
- No. 694. The Edible Canna (*Canna Edulis*), by D. E. McLoughlin.
- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip.Agric.
- No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
- No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
- No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
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REPORTS ON CROP EXPERIMENTS.

- No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
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- No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
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- No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.

TOBACCO.

- No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
- No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
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- No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
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- No. 955. Annual Report of the Tobacco Branch for the year ended 31st December, 1934, by D. D. Brown, Chief Tobacco Officer.

LIVE STOCK.

- No. 624. The Construction of Dipping Tanks for Cattle (Revised).
- No. 749. Dehorn your Commercial Cattle, by W. Fleming, Stock Adviser.
- No. 801. Sheep Farming in the Melsetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melsetter District.
- No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos. School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.
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- No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
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- No. 919. Saltbush: A Winter Succulent for Sheep in Matabeleland, by D. G. Haylett, M.Sc., Ph.D., Director, Matopo School of Agriculture.
- No. 924. Raising Dairy Calves on a Limited Amount of Whole Milk, by C. A. Murray, M.Sc. Agr., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

- No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position chiefly as regards Ranching Cattle, by Dr. A. E. Romyn, Chief Animal Husbandry Officer.
- No. 944. Pig Feeding Demonstration. The use of Balanced and Unbalanced Rations for Growing Pigs, by C. A. Murray, M.Sc. (Agr.), Senior Animal Husbandry Officer I/C., Matopo School of Agriculture and Experiment Station.
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- No. 946. Economical Rations for Wintering Dairy Cattle, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.
- No. 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.

DAIRYING.

- No. 520. Treatment of Gassy Curds in Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 530. The Dairy Industry: Causes of Variation in Cream Tests, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 594. Milk Recording and its Advantages, by T. Hamilton, M.A., N.D.A., N.D.D. Introduction by J. R. Corry, B.Sc.
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- No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.
- No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.
- No. 818. Farm Butter-making—Issued by the Dairy Branch.
- No. 844. Southern Rhodesia Milk Recording Scheme.
- No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.
- No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.
- No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.
- No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.
- No. 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer

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- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
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- No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcome, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.

- No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 666.—Notes from the Veterinary Laboratory: Præmonitus—Præmonitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
- No. 756. Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
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- No. 921. Myiasis (Screw-Worm) in Cattle in Southern Rhodesia, by D. A. Lawrence, Director of Veterinary Research, and A. Cuthbertson, Entomologist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

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- No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).
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- No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
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- No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
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- No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
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- No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
- No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
- No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
- No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
- No. 809. Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.
- No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.
- No. 857. Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.
- No. 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.
- No. 874. Tree Planting, by the Division of Forestry.
Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.
- No. 888. The Vegetable Ivory Palm (*Hyphene ventricosa*), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.
- No. 927. Some Facts about Tung Oil, by R. H. Finlay, B.A., Dip. For. (Oxon), District Forest Officer.
- No. 928. Some, Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suit for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

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- No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.
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- No. 814. Avocado Growing in South Africa, by Redvers J. Blatt, B.Sc., Ph.D.
- No. 821. Vegetable Growing in Southern Rhodesia—Lettuce, by G. W. Marshall, Horticulturist.
- No. 824. Vegetable Growing in Southern Rhodesia—Tomato Culture, by G. W. Marshall, Horticulturist.
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- No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.
 No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.
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- No. 696. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.
- No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 754. "Pinking" of Maize—Report of a Preliminary Investigation, by T. K. Sansom, B.S., Plant Breeder.
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- No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
- No. 796. The Army Worm (*Laphygma eximpta*, Wlk.), by Rupert W. Jack, Chief Entomologist.
- No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
- No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
- No. 847. The Lesser Tobacco Wireworms, by Rupert W. Jack, Chief Entomologist.
- No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases—3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).
- No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
- No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.
- No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
- No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
- No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.

- No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
- No. 893. Experiments with Tsetse Fly Traps against *Glossina morsitans* in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
- No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
- No. 896. A List of Plant Diseases Occurring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
- No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 899. The Black Maize Beetle (*Heteronchus licus* Klug), by C. B. Symes.
- No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.
- No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.
- No. 911. Screw Worm: A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.
- No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.
- No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.
- No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.
- No. 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7. Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.
- No. 942. Mycological Notes.—Seasonal Notes on Tobacco Diseases.—8. The Mosaic Mystery. 9. Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
- No. 951. Suspected "Streak" Disease of Maize. Notice to Growers. By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

POULTRY.

- No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.
- No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.
- No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.

- No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
- No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.
- No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.
- No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
- No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
- No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).
- No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
- No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).
- No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 918. The Moulting of Poultry: The Normal and Pullet Moults, by H. G. Wheeldon, Poultry Officer.
- No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.
- No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

The following pamphlets can be obtained from the Poultry Expert upon application:—

- Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
- Tuberculosis, by A. Little, Poultry Expert.
- Prevention of Disease among Poultry, by A. Little, Poultry Expert.
- Preparing Birds for Show, by A. Little, Poultry Expert.
- The Fowl Tick (*Argas persicus*), by A. Little, Poultry Expert.
- Culling: A Seasonal Operation, by A. Little, Poultry Expert.
- Choosing a Male Bird, by A. Little, Poultry Expert.
- The Breeding Stock, by A. Little, Poultry Expert.
- Diseases of the Digestive System, by A. Little, Poultry Expert.
- Mating for Improvement and Increased Egg Production, by A. Little, Poultry Expert.
- Partial Moults: Broodiness: Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
- Exhibiting Eggs at Shows, by A. Little, Poultry Expert.
- Condition of Birds on Show, by A. Little, Poultry Expert.
- Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
- Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
- Grading Fowls, by A. Little, Poultry Expert.
- Housing: Three Important Essentials, by A. Little, Poultry Expert.
- Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
- Seasonal Hints—August, by A. Little, Poultry Expert.
- Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
- Hints to Breeders, October, by A. Little, Poultry Expert.
- Abnormalities in Eggs, by A. Little, Poultry Expert.

- Hints to Breeders. Prepare for the Breeding Season, by A. Little.
 Respiratory Diseases, by A. Little, Poultry Expert.
 Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
 The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

- No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
 No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
 No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
 No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

- No. 554. Pisé-de-Terre, by P. B. Aird.
 No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
 No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
 No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
 No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
 No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.
 No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
 No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.
 No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.
 No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.,
 No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.,
 No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

MISCELLANEOUS.

- No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.
- No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.
- No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
- No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.
- No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.
- No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
- No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
- No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.
- No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.
- No. 858. The Softening of Waters, by the Division of Chemistry.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.
- No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.
- No. 930. Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.
- No. 931. Charcoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.
- No. 935. The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.
- No. 949. Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.
- No. 953. A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.
- No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Charley, F.R.E.S., and R. McClhery, B.A., B.Sc.
- No. 958. A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.

THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

AUGUST, 1935.

[No. 8.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Committee of Enquiry.—It is intimated for general information that the Government has decided to appoint a Committee to enquire into certain aspects of the Pig and Dairy Industries in the Colony. The personnel of the Committee is as follows:—William Purdie Currie, Esq. (Chairman), Archibald Maclean, Esq., John Campbell, Esq., Kenneth Mackenzie Goodenough, Esq., Edward Roland Jacklin, Esq. The following are the Committee's terms of reference:—

Dairy Industry.—To enquire into and report on the present position and future of the dairying industry of the Colony with special reference to:—

- (1) the constitution and operations of the Dairy Industry Control Board and the maintenance of the butter and cheese levies,

- (2) the desirability or otherwise of extending the powers of the Board to enable it to determine the price to be paid to the producer for milk or butterfat and similarly to determine the wholesale and retail prices of butter and cheese sold in the Colony,
- (3) the large amount of low grade cream delivered to the creameries and the resulting high percentage of second and third grade butter produced,
- (4) the excessive competition which arises at certain seasons of the year between farm and creamery butter, and the means, if any, which should be adopted to deal with this situation,
- (5) the requirements of the Colony in respect of creameries, and the steps which should be taken to limit the number of these requirements,
- (6) means by which expansion of the industry may be encouraged on an economic basis and by which it may be rendered more profitable to producers.

Pig Industry.—To examine and report on the pig industry of Southern Rhodesia with particular reference to:—

- (1) the possibility of the profitable expansion of the industry with due regard to the prospects of and measures necessary to develop the export trade,
- (2) the local costs of manufacture and distribution of pig products,
- (3) the competition encountered by local pig products due to importation of similar products from overseas or adjoining territories and the extent to which such competition reacts to the disadvantage of the industry,
- (4) the desirability or otherwise of introducing a system for the grading of pigs on delivery to bacon factories and of fixing minimum prices for each grade,
- (5) any other aspects of the position which it is considered will lead to the better and more profitable organisation and development of the industry.

The Committee will sit at Salisbury, Bulawayo, Gatooma, Que Que, Gwelo, Fort Victoria, Enkeldoorn, Umvuma, Chipinga, Rusape, and Umtali on dates to be notified later.

Any persons interested who are desirous of giving evidence before the Committee are requested to furnish their names in writing to the Secretary of the Committee, F. Gillwald, Esq., Department of Agriculture, Salisbury, together with, if possible, a note indicating the gist of the evidence they intend to submit, also stating at which of the above mentioned towns they desire to appear.

The Late Mr. Charles Mainwaring.—In the untimely death of Charles Mainwaring, on the 21st July, at the comparatively early age of 61, the Colony has lost a good friend and one who was untiring in his efforts to serve the farming community. Joining the Rhodesian Service on 29th December, 1918, as an Agriculturist at a time when the head of the Branch of the Agricultural Department was still absent on military service, and when the Senior Agriculturist, the late Mr. J. A. T. Walters, on account of ill-health, had been forced temporarily to relinquish his duties, the late Mr. Mainwaring at once made his strong personality and sound knowledge of agriculture a living force, both within the Department and amongst all those actually engaged or interested in agricultural and horticultural pursuits. In those relatively palmy days of the maize industry he was mainly responsible for encouraging Rhodesian growers to exhibit their maize on the Rand Show in the 500-ear and smaller classes, and his knowledge of selection and staging contributed largely to the many notable successes which were achieved on that Show by exhibitors from this Colony. Largely, too, due to his urging, may be attributed the building of the Maize Hall on the Salisbury Show Ground of the Agricultural and Horticultural Society, and no man was more pleased and proud than he at the truly wonderful exhibits of maize which as a result were for a number of successive years, and until the world price of maize collapsed, displayed in that hall.

Essentially a field husbandry officer, Charles Mainwaring rapidly became known amongst farmers as the "Maize

Expert" of the Department, and many were the demands upon the Department for his services as a lecturer and demonstrator at meetings of Farmers' Associations, as a personal advisor to individual farmers, and as a judge in the Produce Sections at the various Agricultural Shows.

Sound methods of field husbandry was the constant theme of his teaching, and though the general agricultural depression of the last few years has to some extent caused that advice, temporarily or in part, to be neglected, there will, we believe, be none who do not remember his sage councils with full appreciation of their merits.

As agricultural representative of this Colony at the Southern Rhodesia section of the British Empire Exhibition in 1924, Charles Mainwaring was a no less successful and outstanding personality, and later when he assumed the position of Manager of the Rhodes Matopo Estate Experiment Farm, he immediately gained the esteem and friendship of all those farmers in Matabeleland—and they were many—with whom he made contact.

He was a skilled gardener and a great lover of flowers, and wherever he resided Charles Mainwaring surrounded himself with beautiful flowers, and encouraged and taught others to do the like for themselves.

As Secretary of the Rhodesia Agricultural and Horticultural Society, Salisbury, as a member of the Committee of the Salisbury and District Garden Club, as a tried and trusty friend and a good Rhodesian, Charles Mainwaring will be sadly missed. But he has not passed away without leaving his mark on this country which he loved, and all the influence which he exerted was, we believe, for her good.

Chief Tobacco Officer on Sick Leave.—We regret to announce that Mr. D. D. Brown, Chief Tobacco Officer, has been ordered to take two months' sick leave and will not be able to fill his engagements with tobacco growers. Correspondence will be dealt with from the Salisbury office by Mr. H. F. Ellis, M.Sc., Tobacco Officer of the Trelawney Tobacco Research Station, during Mr. Brown's absence from office.

Meteorologist Attends Conferences.—Mr. N. P. Sellick, M.C., B.Sc., Meteorologist of the Department, has left on six months' leave of absence. It is his intention to attend two important conferences, that of Empire Meteorologists to be held at the Air Ministry, London, during August, and the international Conference of Meteorology at Warsaw from the 5th to the 12th of September.

Chilled Meat Trade.—The attention of the Secretary, Department of Agriculture and Lands, has been drawn to the fact that a number of farmers and dealers are inclining towards the fattening of aged bullocks for the chilled meat trade.

These feeders are advised that, though it has been necessary to allow some latitude recently in regard to the age of the cattle exported in order to maintain regular supplies from the restricted areas available for export, this necessity has now disappeared, and it is the intention of the Department to revert as soon as possible to the standard of age and quality as laid down in the regulations for first grade chilled beef.

Those who are feeding, or are planning to feed, aged bullocks are, therefore, advised in their own interests, to communicate with the Department of Agriculture and Lands, or with the Rhodesia Export and Cold Storage Company, with a view to ascertaining whether the bullocks in their possession are likely to be passed for export as chillers, or not.

Foot and Mouth Disease.—Material Improvement in Position.—The following official statement is issued by the Secretary, Department of Agriculture and Lands:—

Since the outbreak of foot and mouth disease in April last in the Selukwe Reserve, and on certain adjoining farms, there has been no extension of the disease in that area, except on the farm Muirhead, adjoining the Reserve, but still within a declared infected area. No infection has occurred beyond the declared infected area. All cattle within the original area of active infection, numbering 32,934 head, were inoculated, and this process was completed on the 23rd May, inoculation

on Muirhead farm being completed by the last week in June. The extension to Muirhead was due to contact with inoculated cattle on the adjoining Selukwe Reserve through the intervening fence.

There has been no other extension of the disease in the territory, except in the Salisbury district, where the disease was diagnosed in a native herd at Chishawasha Mission on the 24th April, immediately adjoining the Chinyika Reserve, on which the cattle were inoculated on the 12th April. Chishawasha Mission cattle, numbering 1,696 head, were inoculated on the 10th May. A further extension of disease was diagnosed on Chitarra farm on 22nd May. These cattle, numbering 337, were inoculated on the 6th June.

Since the above mentioned outbreaks there have been no further extensions of the disease, and there is at present no known active infection in the territory.

Intensive supervision is being exercised over all areas in which infection has occurred and over adjoining areas, and precautions to prevent the possible dissemination of the disease from one district to another are still being intensively enforced, especially in regard to the "Western Area," to which no cattle are allowed to proceed, except to the abattoirs for immediate slaughter, and then only from places outside the semi-quarantine areas, and after a period of 14 days' quarantine during which the animals are subject to regular inspection.

A system of more intensive supervision of all native-owned cattle in and around areas in which the disease has occurred has been established by the Department of Native Affairs, through its staff of dip tank supervisors acting in collaboration with the officials of the Veterinary Department.

With the exception of the Selukwe, Fort Victoria, and Salisbury districts, the territory has been free from foot and mouth disease for over nine months, and in the "Western Area" there has been no disease since November, 1932.

The Government is approaching the Union Government in regard to the early opening of the Johannesburg market for cattle on the hoof from the "Western Area" of this Colony.

Sericulture in the Empire.—The following extract from the Annual Report of the Imperial Institute, 1934, is of interest.

“At a special meeting the Chairman invited the Committee to consider the present depressed condition of sericulture and its bearing upon the question of promoting the production of raw silk in the British Empire. After reviewing the economic circumstances, which have rendered the commercial production of silk unprofitable in Europe and the Near East, the Committee concluded that, under present circumstances, there is little prospect of effective work in sericulture as a commercial undertaking in Empire countries, other than India, where silk-raising is already an important established industry. For the time being, therefore, the Committee do not propose to make any recommendations for encouraging the production of raw silks in British countries seeking new industries, except in cases where small local industries seem likely to be successful. They will continue to watch with interest the progress of the efforts now being made in certain Provinces and States of Indian to encourage the development of the indigenous silk industry.”

Tobacco Seed-Bed Fertilisers.—The availability of plant food materials for tobacco plants in the early seedling stage apparently has some effect on the vigour and growth of the young plants. An experiment under observation at the Dominion Experimental Station, Harrow, Ontario, demonstrates very clearly that nitrogen alone on a black soil surface may seriously influence the germinating seeds and retard the growth of the plants. The same quantity of nitrogen in a complete fertiliser produced an excellent growth of plants. Potash alone in the form of sulphate of potash had no detrimental effect on the plants after germination, but the stand of plants in the bed was not as thick as that produced by the complete fertiliser. With phosphate alone no injurious effect was observed on germination, but the rate of growth again was less vigorous than that produced by the complete fertiliser. A treatment without nitrogen including the phosphate and potash only, gave a better growth than treatments without any commercial fertiliser.

Assistance in setting out Soil Conservation Works.—The employment of suitably qualified local technical assistants for setting out soil conservation works has been approved by the Government.

Mr. T. J. Mossop has been appointed in the Glendale-Bindura area and Mr. D. Aylen in the Concession and Umvukwes area for this purpose. It is considered that the appointment of these assistants will materially expedite the setting out of these essential works, and farmers who wish to take advantage of their services should make application in the ordinary way to the Irrigation Division, P.O. Box 387, Salisbury.

NOTICE.

VACANCY FOR MILK RECORDER.

Applications are invited for the post of Milk Recorder in the Department of Agriculture and Lands at a salary of £25 per mensem. No travelling and subsistence allowances will be paid, but otherwise the appointment will be subject to the Civil Service Rules and Regulations.

Applicants should possess a recognised dairying diploma or its equivalent, and should preferably have had experience of practical work in creameries and cheese factories.

Applications, which should state date on which applicants can assume duty and be accompanied by copies of testimonials, should be addressed to the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury, Southern Rhodesia, and should be forwarded so as to arrive not later than the 15th August, 1935.

Canvassing will disqualify applicants.

H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

23rd July, 1935.

NOTICE.

TUNG OIL FRUIT (CLUSTER TYPE) REQUIREMENTS, 1936.

To enable the Department of Agriculture and Lands to ascertain in advance the requirements of intending growers of Tung Oil (*Aleurites fordii*) during the year 1936, farmers and others are invited to furnish their requirements under this heading to the undersigned not later than 31st August, 1935.

It is estimated that the cost of Tung Oil seed in fruit form to consignees' stations or sidings will be approximately 2s. 3d. per lb. of fruit for the year in question, but no definite assurance can be given at this date that the above cost will not be exceeded.

Orders should be accompanied by cash or cheques endorsed by the Bank and made payable to the Accountant, Division of Agriculture and Lands, Salisbury, on 1st January, 1936.

The Government only accepts orders and cash deposits on the clear understanding that no legal liability shall attach to the Government if it fails, for any reason whatsoever, to fulfil the whole or any portion of an order.

Applicants will be held liable for the cost of their requirements if between the date of application and the date of delivery they decide to withdraw their order.

Whilst every endeavour will be made to supply the full requirements of applicants, no guarantee will be given that such quantities will be available. If it is found that supplies of seed will not enable this Department to meet in full the orders placed with it, the Department reserves to itself the right to make a *pro rata* distribution of seed in fruit form.

Tung Oil seeds are sold in fruit form to assist in the preservation of the seeds' viability.

There are approximately 76 seeds per lb. of fruit, and a germination percentage of about 50 may reasonably be expected while the seed is fresh. No guarantee is, however, given.

Under normal circumstances, fruit should be available for distribution about February, 1936.

H. G. MUNDY, Secretary,
Department of Agriculture and Lands.

A HOME-MADE RIDGER.

(Contributed by Mr. DOUGLAS AYLEN, Somerset, Concession.)

The construction of contour ridges, or more correctly, ridge terraces, by means of ridging implements drawn by oxen or tractor, has proved a great deal cheaper and quicker than constructing them by hand. Unfortunately, however, the implements at present on the market, although useful up to a point, are not ideally suited for this purpose, and the writer has experimented with a view to producing something more satisfactory and has evolved the ridger shown in the accompanying photographs. (Fig. 1.)

A drawing showing the constructional details and embodying certain minor improvements has been prepared by the Irrigation Division and is reproduced herewith, as it is believed that a number of farmers may be anxious to construct this implement themselves. Those who are unable to do so will doubtless be interested to learn that Messrs. Hampson & Lockie are producing a very serviceable all-metal ridger with adjustable blade of approximately the same dimension and embodying similar features at the price of £14 10s. 0d.

The construction of this ridger may be too big a job for some farmers, but those possessed of the necessary tools and some mechanical skill should have little difficulty in making one.

The dimension of the materials shown on the drawing, which are stock sizes, although recommended, are not vitally important, and odds and ends such as old wagon tyres and pieces of timber of approximately these sizes, which a farmer may have on hand, can be made use of.

The grader arm and land slide should be completed first and then be joined together by the cross struts.

The grader arm consists of two 9 inch \times $1\frac{1}{2}$ inch planks 9 ft. 3 inch long, tapering to 6 inches wide at the outer end. These are bolted to the elbows or angle pieces which are carved out of native timber. A template cut from a piece of tin or thin wood to the dimensions shown will give the required angle for these elbows. The object of making the cross section of the grader arm angular instead of flat is to give the iron a better cutting action and it also imparts a rolling movement to the soil. The face of the arm should be covered with sheet iron to prolong its wearing life; this can be of any thickness from 24 gauge to 16 gauge.

Two lengths of iron about 5 inches wide by $\frac{1}{2}$ inch thick, such as old wagon tyres, are then bolted to each edge. The bolts should be $\frac{1}{2}$ inch diameter and pass through the planks and elbows. For preference the holes in the iron should be countersunk for countersunk bolt heads, otherwise cup-headed bolts should be used. The front ends of the iron are bent to an angle of 45° on a slight twist to fit squarely against the iron work of the land slide, to which they are attached with $\frac{5}{8}$ inch bolts.

The land slide consists of a single 9 inch \times $1\frac{1}{2}$ inch plank to the back of which is bolted a piece of timber $4\frac{1}{2}$ inch \times 3 inch to give it the requisite stiffness. Two further pieces of iron 5 inch \times $\frac{1}{2}$ inch are bolted to the plank after being bent round at the front end to form an eye for the hitch bar pin.

A tail plate of $\frac{3}{8}$ inch iron is bolted to the end of the plank as shown.

The grader arm and land slide can now be bolted together at the nose and set at an angle of approximately 45° . The front end of the $4\frac{1}{2}$ inch \times 3 inch timber should be bevelled off and shaped to fit snugly against the grader arm. The details of the cross strut are shown in the drawing. It will be noted that the centre and rear struts are arranged to give as much clearance as possible in order to clear clods of earth which sometimes turn up under the grader arm.

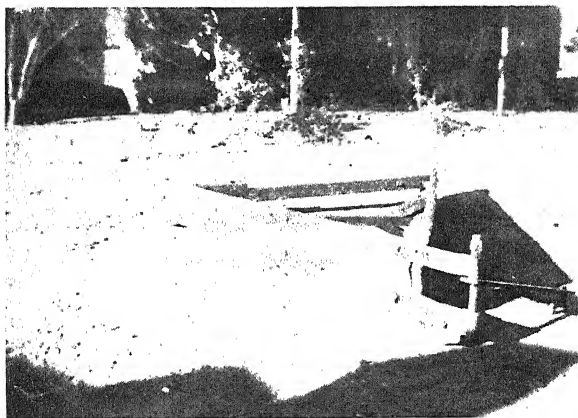
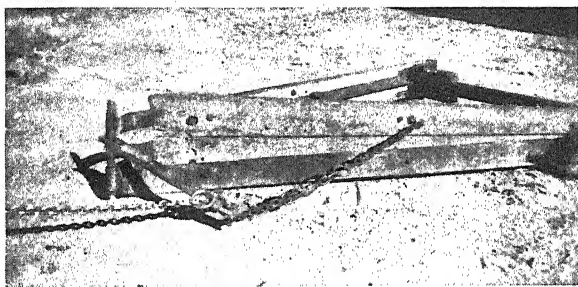
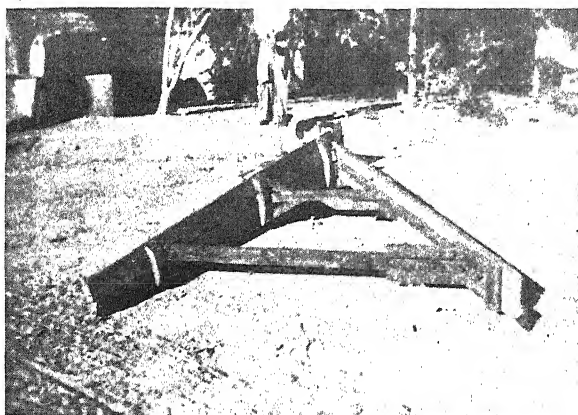
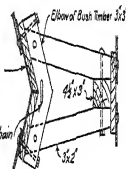
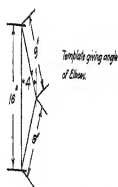
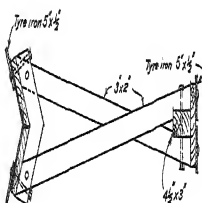


Fig. 1.

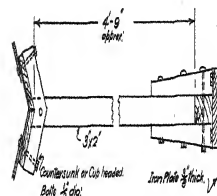
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SECTION ON A-A

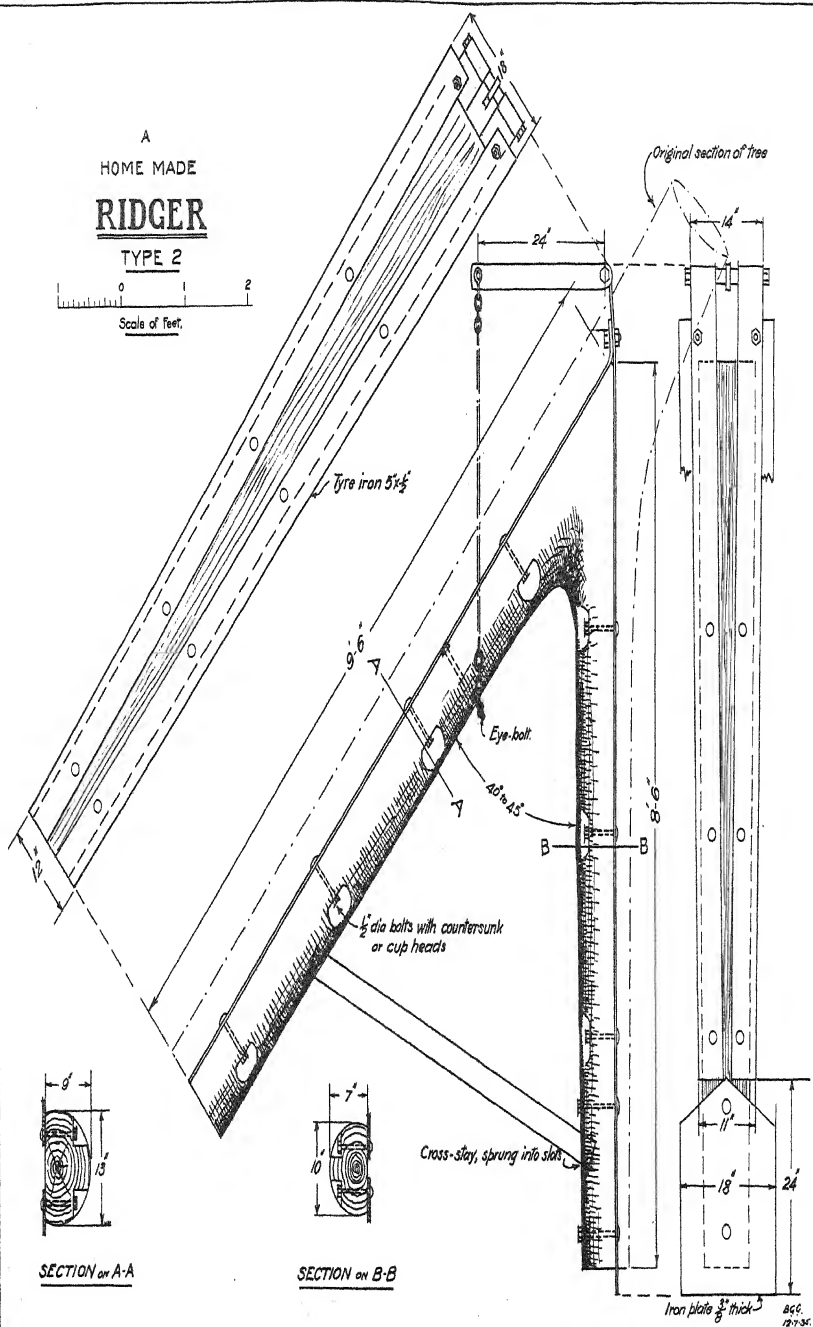
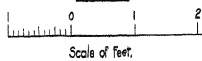


SECTION ON BB.



SECTION ON C-C

A
HOME MADE
RIDGER
TYPE 2



A strong eye bolt is fitted to the front elbow, to which the hitch chain is attached by a hook. Each time the ridger is reversed this chain is unhooked, brought over the upper side of the grader arm and re-hooked to the eye bolt. The length of the chain should be adjusted so that the hitch bar is at right angles to the land slide. It is unnecessary to drill holes in the hitch bar; if the trek chain is given one turn round the bar it can be slid about to the position required. On heavy ground this ridger is a fair load for 18 oxen, and it will be realised that it must be very strongly constructed to withstand the heavy duty imposed upon it, especially where large stones or stumps are likely to be encountered.

Another method of constructing a similar type of ridger, from the limbs of a tree, is shown as Type 2, which may appeal to some farmers on account of its cheapness and simplicity. The writer has not constructed one in this way, but he sees no reason why it should not prove equally effective, especially on heavy soils. For light soils it might prove to be too weighty, but this defect could be remedied by thinning down the limbs, especially the one forming the grader arm.

A suitable tree, hard wood for preference, should be selected having a branch from the main stem projecting at an angle of from 40° to 45° . The girth of the arms measured about 3 feet above the fork should be about 45 inches and 35 inches respectively, assuming the bark is $\frac{1}{2}$ inch thick. The limbs should be shaped with an adze or sawn to the section shown at A.A. and B.B. With a little more trouble the limb forming the grader arm might be cut out to an angle as shown in Type 1 to give the blades a better cutting action.

The iron work should then be bolted to the timber, recesses being cut on the inner sides of the limbs to give a square face for the nuts of the bolt; these, by the way, would have to be tightened up from time to time as the timber dries and shrinks. A cross strut should be sprung or wedged into slots cut in each member to prevent any danger of the fork splitting.

When making of buying a ridging implement it should be born in mind that, speaking generally, the weight of the implement should be more or less dependent on the type of soil on which it is to be used. It has been observed that a heavy iron ridger while giving good results on a stiff soil, is unsatisfactory on a light, friable or sandy soil, the inference being, of course, that for such soils a lighter implement is desirable.

Working the Ridger.—During the relatively short time the writer has been experimenting in the making of contour ridges with this type of implement he has come to the conclusion that each particular type of soil requires a different technique in the use of the ploughs and ridgers, and the best method to adopt on any given type or condition of soil should be determined by experiment. The following brief outline of operations should, therefore, be taken more as a general guide rather than definite instruction.

The simplest way of constructing ridges with this implement which can only be practised on soft ground, is to plough two parallel furrows 8 to 10 feet apart, with a single mould-board plough and work the ridger with the land slide running in the furrow and the grader arm pushing the soil towards the centre. Although the grader will deepen the furrow in all but the hardest soil, it is usually more economical to loosen the soil first with a plough.

In a stiff soil a disc plough is usually used to plough twice round the line of pegs leaving about a foot of unploughed soil in the middle, and throwing towards the centre. If the soil is hard it might be necessary to go over a second time to break up lumps. The rear disc being pushed in to its full depth of about 15 inches on the second round. There will then be two strips of ploughed ground about 6 feet wide on either side of the central unploughed strip. The ridger is now put in the furrow with the grader arm towards the centre and one boy stands on the nose and one on the tail while a third boy partly supports the arm. The oxen are then driven forward walking on the ploughed strip.

This first round cleans the furrow, but on very cracked land, just before the rains, it will be found an advantage to deepen and smooth the furrow with a single furrow mould-board plough before continuing, but the making of ridges on such soil at this time of year is not recommended.

There is now a nice deep furrow in which the land slide can get a good grip and in this next round the work of pushing up the soil into a ridge really commences. The third boy should now stand or squat on the arm to keep it down. The ridger is driven round on each side of the ridge until the ridge itself is about 18 inches high by 8 feet wide with "V" furrows 2 feet wide by 18 inches deep on either side. To widen or raise the ridge the three-furrow disc plough is run round again, usually with only the rear disc ploughing, either taking in new ground or deepening the original furrow. The loose soil thus produced is then graded up as before. This process of ploughing and grading is continued until the ridge is complete. The oxen should be kept walking on the ridge until the final round. When the ridge is finished the furrow formed on the upper side should be filled in by ploughing the soil alongside and working it into the furrow. It will be found that the ridger can be steered by raising or lowering the arm to bring it in or push it out respectively. If the soil is lumpy the live load of natives should be kept forward. If the nose is inclined to run out of the furrow the hitch should be moved nearer to the nose, and if the tail is inclined to kick out of the furrow the hitch should be moved out away from the nose. The boys should be trained to throw their weight on to the arm on approaching a high spot and to raise it on approaching a depression. A stout upright stick may be bolted to the grader arm for the boys to hang on to and to act as a lever on which they can push or pull to control the working of the arm and to help in steering. If the ground is lumpy it will be found an advantage to reverse the ridger by turning it over and running it in the opposite direction: lumps will often be picked out in this way.

It is most important to ascertain by experiment the correct position of the hitch, the length of the hitch chain (usually about three feet long), and the position of the live load, so that the outside oxen walk in the furrow and the

inside oxen walk half way up the slope of the ridge. The oxen will then have a definite line to follow and should not sway. The leaders are pulled out on bends and on reaching a sharp corner the team should be stopped and straightened out. If the hitch and load are properly adjusted the ridger should follow immediately behind the oxen and it should not be necessary to steer with the hind oxen; if it is, some adjustment is wrong.

It is advisable to start off with a team of steady oxen with an obedient leader, and if reasonable patience is exercised with the boys until they get the hang of the work it will be found that they rather enjoy their somewhat precarious rides on the ridger.

It is usually found easier to construct the ridges on unploughed land.

In our next issue we shall publish an article by Mr. C. C. Tapson in which further practical advice on soil conservation work is given.—(Ed.)

The Dangers of Soil Erosion

AND METHODS OF PREVENTION.

Soil erosion is the removal of soil by either wind or water.

In Rhodesia the action of the wind is of little importance and need not be considered at the present time as a serious cause of erosion, and thus we need deal only with what the rainfall does.

If you watch a stream or river in flood, you will notice that the water is always very muddy. Put some of this muddy water into a bottle and allow it to stand for a few days, and you will see the amount of mud which collects at the bottom. When you realise what a lot of mud is held in such a little water and you think of all the soil which must be carried in the flood waters of our rivers, you will begin to realise how much of our country is being washed away every year. If water flows slowly it does not wash away so much soil as it does when it flows quickly, so you will see that the water only becomes our enemy when we allow it to flow too rapidly.

In a country such as this which has normally a good rainfall, Nature, if left to herself, will protect the soil from erosion by providing a dense covering of grass and other vegetation, which will check the speed of the rain water running off the land, and thereby prevent it from doing much damage. When man, however, arrives on the scene these conditions are upset, as he clears the land for the cultivation of his crops, or burns the veld in order to get good early grazing for his cattle. Large areas of country are therefore absolutely bare of all vegetation—except possibly for a few trees—when the heavy thundershowers occur in the early portion of the rainy season.

It has been calculated that in the Mazoe Valley about one-quarter of an inch of soil is washed away every year by rain-water flowing over unprotected cultivated lands.

Those of you who have been brought up on farms will know that the best part of the soil for growing crops on is

the top nine inches of soil, and that it would be the height of folly if we made no effort to prevent ourselves from being robbed of this. If a quarter of an inch of soil is washed away every year, in 36 years all the best soil would be gone and it would take hundreds of years for the processes of Nature to again build up the same amount of good soil.

It is an appreciation of these facts which has caused people to realise that every effort must be made to fight erosion if we mean to continue farming in this country. Soil erosion is a problem which faces the whole of Africa, and its evil effects are most marked in the older settled portions, such as the Union; but unless we tackle it at once, in a very short time we will find that we also have lost all our soils.

In 1920 the Government in the Union appointed a number of well qualified people to investigate drought conditions, and the final report of these persons, or Commission as it was known as, was issued in 1923, and is still a most valuable book of reference, which should be read by all who are interested in their country, and who wish to prevent our good soils from being lost.

The following extracts from the report show the seriousness of the position, and indicate that the evils of soil erosion do not end merely with the loss of valuable soil but that the ultimate effects are a lessening of the water supplies and a lessening of the usefulness of the rainfall:—

“Since the white man has been in South Africa enormous tracts of country have been entirely or partially cleared of their original vegetation, with the result that rivers, vleis and waterholes described by old travellers, have now dried up or disappeared. This drying out of extensive areas is still proceeding with great rapidity in many portions of the country.”

“The rains of last generation falling on unbroken, understocked grazing lands were most lasting in their beneficial results than rains of equal magnitude falling to-day on veld overstocked, tramped-out, semi-waterproof, hard-baked by sun and veld fires. The heavy thundershower falling on thickly-grassed virgin veld produced only a trickle in the water-courses of former days compared with the torrents rushing down the dongas of our eroded sections under similar circumstances to-day.”

And the whole case is summed up in the following serious charge:—

“Your Commissioners are convinced by the evidence submitted as a result of conditions created by the white civilisation in South Africa, the power of the surface of the land, as a whole, to hold up and absorb water has been diminished, that the channels by which the water reaches the sea have been multiplied and enlarged, with the result that the rain falling on the sub-continent to-day has a lower economic value than in days past. If these processes are permitted to continue the *logical outcome of it all is The Great South African Desert uninhabitable by man.*”

Although this report was so convincing little of any value was done in the Union for a long time until about two years ago when a national propaganda campaign was started, backed up by funds provided by the Government, to subsidise the cost of the construction of the necessary works. General Smuts, when speaking on this subject in the Union House of Assembly, said that it was the biggest problem that that Parliament had ever tackled, and to all who have studied the subject these words carry the essence of truth.

In Southern Rhodesia the officials of the Irrigation Division of the Department of Agriculture have been preaching the necessity for fighting soil erosion since 1923, and they have been backed up each year by more farmers who have seen the irreparable damage caused to their unprotected lands each rainy season and who have realised that the soil can only be saved when the lands are protected by suitable works. It has been a very slow process teaching this truth to farmers, as the farmer is naturally a conservative person who, before he spends any money, wishes to see with his own eyes that the proposed remedy is a certain cure and, therefore, worth while.

Even now it is only in a few of the farming districts that the construction of works to save the soil are being generally undertaken. Of course, the last ten years have been very difficult ones for the farmer and he has had to cut down his expenditure to the barest minimum.

You will realise that there is still a tremendous amount to be done when you are told that *less than ten per cent. of the lands under summer crops in this country are suitably protected and that each year only two per cent. more land is protected.*

If this rate of progress is not considerably speeded up we will have lost the soil from more than half our lands before they can be protected.

In a country such as this where the amount of good soil is definitely limited in extent, this is the most serious aspect of the matter and it is the one which induced the Rhodesian Agricultural Union Congress in 1931 to ask the Government to take all the steps possible to save the soils of the country.

That Agricultural Union later appointed a special committee to investigate all aspects of the problem and a valuable report was issued towards the end of 1932 which recommended the establishment of two Special Councils, known as *Soil Conservation Advisory Councils*, to carry out propaganda work and investigations and to advise the Government on the best ways of preventing soil erosion. These Councils were formed last year and, assisted by local Soil Conservation Committees, are now carrying out a very active campaign, as it is considered that first the public must be taught all the dangers of soil erosion and then, if necessary, laws can be brought in to deal with the matter. *Prevention and continual watchfulness* are the passwords necessary in this work. Compulsion by Act of Parliament is useless unless we can look to the individual to undertake willingly the work for the good of himself, of his children and of the State. The State itself, of course, must do its share by providing money on easy terms of repayment to farmers, who construct the necessary works, and must also put its own house in order by preventing erosion in the extensive native areas and on unoccupied land.

Enough has been said to make you realise the general nature of the evil, and it remains to outline broadly the manner in which it can be cured or prevented.

Erosion occurs in two main forms, *viz.*,

(a) Donga or sluit formation.

(b) Sheet erosion, or sheet washing.

The donga is the most obvious form of soil erosion, and you are all doubtless familiar with the ugly gashes which run through lands, which were formerly vleis and which were cleared for cultivation without heed being taken of how the flood water was to be controlled after the natural surface vegetation had been removed.

Dongas also occur in the veld and usually begin to form along old abandoned roads and cattle tracks.

This form of erosion does most damage by permanently lowering the level of the underground water in its vicinity. The reason for this is that once a donga is formed the underground water can never rise above the bottom of its bed, and as the bed gets deeper so the water level gets lower and lower.

Where formerly you had a vlei or marsh which drained slowly throughout the winter and formed a running stream, you now have a donga which only flows at intervals during the rains.

When this occurs on an extensive scale it eventually means that the springs dry up and there is little or no winter flow in the rivers.

Those of us who have been any length of time in this country know that that is what is actually occurring here, and the drying up of many streams and the smaller winter flow in the main rivers is not wholly explained by a change in the rainfall.

The tales of the old hands that this was a land of continually flowing streams and extensive vleis are not entirely myths, but are hard to believe when we see dry stream and river beds all over the country.

It is easier and less expensive to prevent dongas from forming than it is to deal with them after they have been made, so let us see how they can be prevented.

(1) Never cut a channel through a vlei to drain it unless the channel is cut on so flat a slope that it can always be blocked and the vlei reformed.

(2) Do not plough your vlei lands unless they are the only suitable lands for cultivation; but if you must do so, always

leave a broad strip with undisturbed vegetation along the bottom over which the storm water can flow.

(3) Do not overstock the farm, as this is the surest means of tramping out the vegetation and results in the formation of dongas.

(4) Do not kraal the stock at night if this can possibly be avoided, as this inevitably means the formation of innumerable cattle paths in the vicinity of the kraals but, if kraaling is a necessity, place the kraals on practically flat land so that water flowing along the cattle tracks will only be able to move slowly and will not be able to erode them into dongas.

(5) Provide as many watering places for the stock as is economically possible, and have them so located about the farm that the cattle have not to be definitely driven to water, but can range freely and drink whilst they are grazing; the reason being the same as before, that is to prevent the formation of cattle paths, which may develop into dongas.

The ideal is, of course, the division of the farm into a number of fenced paddocks with a water supply in each, as this enables the cattle to roam freely without herding and enables the grazing to be properly controlled. Under present circumstances, however, this can only be an ideal to be borne in mind and gradually realised as opportunity offers.

(6) Clear fireguards around the farm each year in order to prevent your vegetation from being burnt out.

(7) *Graze down or cut your grass, do not burn it*, as it can be stated that with very few exceptions it is definitely harmful to continually burn the grass; burning not only enables soil erosion to take place but it destroys the valuable humus in the soil and the seeds of the finer grasses which are the best for cattle. Grass improves with mowing or controlled grazing, but gets coarse and unpalatable with burning.

(8) Do not cut out any trees along the banks of rivers and streams, but encourage the growth of timber and brushwood there, as the roots help to bind the banks and prevent them from eroding.

Do not cut down all the trees on steep hillsides, but always leave sufficient trees standing to afford shade and protection to the soil.

(9) Replant areas which have previously been cleared of trees and are not required for cultivation or grazing purposes. You will never see a donga in a good plantation, and the best way of encouraging rain water to penetrate into the soil is to plant trees on it. Forests do not actually increase the rainfall, but they render the soil much more capable of holding water and are, therefore, of great benefit apart from the actual value of the timber itself.

(10) Do not allow the farm roads to become drains for the storm water because, if you do so, they will soon become dongas and you will have to construct new roads. Decide on the best position for the farm roads and then construct them with proper storm drains on either side and with a slight slope from the centre of the road to each drain to enable the rain water to flow off the road into the drain on either side.

These are the ten commandments of good stock farming without erosion, and although at the first onset it may seem a tremendous lot to have to think about, yet it is a case of "mony a mickle makes a muckle," and once adopted as ordinary routine there will be no big problem of soil erosion to worry over. The case of dongas which have already formed is another matter, and here the golden rule is to catch them young, because then they are easily cured, but if you allow them to grow old in their evil ways they will break your heart and your purse.

The one essential is to put barriers across their courses at intervals so as to check the speed of the water which will then drop the silt it was carrying along and this will fill up the donga. Afterwards, if quick growing vegetation is planted on this silt, you will have your donga held and definitely beaten for all time.

These barriers have to be constructed at sufficiently frequent intervals so that the water banked up by a lower one extends to the foot of the one above. The steeper the slope, therefore, the more barriers you will have to construct.

In the case of dongas in their very early stages, merely planting strips of thick growing vegetation, such as Napier fodder, will suffice to do the trick, but if they are already properly formed with defined banks, then low dams made by

driving timber stakes into the ground and lacing them with grass or brushwood are necessary. In order to prevent the donga washing round the sides of such a barrier the banks must also be protected with brushwood where the ends of the barrier meets them.

In the case of larger dongas the barriers have to be constructed of boulders covered and laced in wire netting to form a bolster of sausage about 2 feet 6 inches in diameter.

The sides of the donga and the bed in front of the bolster have also to be protected with an apron of stone.

In the case of large dongas it is useless to carry up the barriers to the top of the bank and expect it to be cured in one season. The best practice is to construct a low bolster first and then heighten it by an additional one each season. In addition the sides or deep dongas have to be sloped back and planted with vegetation, as if they are left with vertical sides, they will be undercut by the water and your donga will be continually widening.

It will be seen that the expense of reclaiming dongas increases rapidly with their size, and as previously mentioned, it is therefore good business to check them before they are large, as the expense is then negligible and it is merely a matter of attention to detail.

With regard to sheet erosion, this is the washing away of soil and humus from cultivated or cleared lands. It is a very dangerous form of erosion as in its early stages there are very few visible signs of its presence, but if allowed to continue unchecked for a few years, little channels in which the sub-soil is exposed will be found to be forming through the land, and these are the finger prints of dongas, which will develop later.

In addition, as the top soil is washed off more and more, subsoil will be turned up each year when the land is ploughed and the crops reaped will fall off every year, although expenditure on fertilisers has been increased.

There are cases, of course, where extensive areas of ploughed land have been scoured down to the subsoil in a few hours when a particularly intense storm has been experienced,

and then the sufferer has definitely to sit up and take notice, but usually the development of sheet erosion is a stealthy and gradual one, and for this reason is all the more dangerous. It is therefore very advisable to protect ploughed lands against erosion as soon as they have been cleared for cultivation and not wait until the signs of sheet erosion are definitely visible.

What then are the measure which have to be taken to protect these lands? First of all storm drains have to be constructed above these lands to catch the storm water that would otherwise flow on to these lands from the veld surrounding them.

It is necessary to have expert advice on the construction of these drains, as they have to be of ample size to deal with the most severe conditions of flood from the catchments they drain, and must be set out on a regular slope, because if you have sections of steep and flat slopes the flat sections will merely silt up and overflow in heavy storms and then the cure would be worse than the disease. The drains can be made to carry more water by placing the material excavated from the drain a few feet away from its lower edge and forming a regular embankment there.

Apart from keeping water from the veld from flowing on to the lands the rain water flowing off the cultivated land itself has to be controlled, as if the land is of any extent, and is on a slope, erosion will occur if the flood water is allowed to follow its natural courses unhindered down the steepest slope.

The method of preventing this is to construct ridges or earthen embankments about 2 feet in height across the land at regular intervals. These ridges do not run absolutely level but have a slight fall of 1 foot in 400 feet, and are spaced at closer intervals on steeply sloping land than on land which is flatter. The maximum drop in the ground between one ridge and the next is 7 feet 6 inches, but it is preferable to have not more than four feet drop between ridges, and the maximum distance between ridges is never more than 100 yards. Ridges should not be more than 500 yards long. These ridges divide the land into a number of narrow strips which are approximately parallel to each other. Any soil which may

be washed off the land by rain collects behind each ridge and by this means very little soil is lost from the land and the ultimate effect of the ridges will be to convert a sloping land into a series of level terraces. These ridges may be constructed either by hand labour or by means of implements such as the Martin ditcher, which scrapes soil off the land and builds it into a ridge, or by dam scoops. The cost of this ridge terracing, as it is called, varies with the method employed, and is usually between 2s. 6d. to 3s. 9d. per every acre protected, so that the cost cannot be regarded as too high when the benefits derived are so enormous.

The only objection advanced by some farmers against this type of protection is that ploughing difficulties are increased and that the area available for cultivation is decreased. However, it is being increasingly realised that these are short-sighted objections, as the construction of these ridges is the only method to adopt if you are eventually to have any land at all which will grow crops.

At present it is not usually considered necessary to protect lands which lie on a flatter slope than 1 in 100, but it is very probable that these flatter lands will have to be protected in time, but in any event it is absolutely necessary to construct storm drains above such lands, and it is always advisable to do the last ploughing roughly across the slope of the land and not down the slope. The evil effects of ploughing down the slope are visible in old native lands in the Reserves.

The one golden rule in all soil protection work is to get expert advice and not to try and cut down on the size of drains or ridges recommended, as the few pounds saved in this way will be lost many times over when a real storm hits you.

An insurance which does not cover all risks is waste of money, and there is no question that the only sound insurance for retaining our soil is the proper construction of soil conservation works.

Principal Summer Crops in Southern Rhodesia.

Issued by the Government Statistical Bureau.

Estimated Acreages 1934-35 compared with Actual Acreages 1933-34.

Crops.	Season 1934-35.	Season 1933-34.
	Estimated area planted. Acres.	Actual area planted Acres.
Tobacco—Virginia :		
Flue-cured	38,060	39,748
Fire-cured	1,880	1,550
Other	30	80
Total	39,970	41,378
Turkish	1,730	1,423
Total Tobacco	41,700	42,801
Cotton	5,760	3,208
Maize	260,370	246,371
Ground nuts	7,550	7,109
Potatoes	1,900	1,801
Green manure crops	55,350	46,130

From the foregoing figures it is evident that the area planted to every crop except tobacco has increased. The season 1933-34 was on the whole favourable to summer crops and yields were in most cases very satisfactory, but the outlook for the season 1934-35 is not as hopeful. Owing to the excessive rains at the beginning of the season and the subsequent long dry spell it is anticipated that the yield per acre of most crops will be much lower than in 1933-34.

Tobacco.—The estimated acreage under Virginia flue-cured tobacco shows a decrease of about 1,700 acres, or 4 per cent. There has been, however, a small increase of 330 acres under fire-cured tobacco, and the area planted to Turkish leaf has increased from 1,423 acres to 1,730 acres.

Cotton.—The area under this crop continues to expand. It is estimated at 5,760 acres compared with 3,208 acres in 1933-1934 and 1,899 acres in 1932-1933.

Maize.—During the last few years the acreage under this crop has remained more or less unchanged, but for the season under review it appears that an increase of $5\frac{1}{2}$ per cent. has occurred, from 246,371 acres to 260,370 acres. The consensus of opinion is that the yield per acre will be poor and the total crop considerably smaller than in the previous season.

Ground Nuts.—An increase of about 400 acres is reported under this crop, and it is considered that the output will in all probability meet the local demand.

Potatoes (Summer Crop).—It is estimated that the area under this crop will approximate to last year's acreage, *i.e.*, 1,900 acres as against 1,801 acres in 1933-1934.

Green Manure Crops.—The area to be ploughed in for the purpose of green manuring is calculated at 55,350 acres compared with 46,130 acres in 1933-1934. This represents an increase of over 9,000 acres, or 20 per cent.

MEAT.

An excellent bulletin dealing with the meat position in the world was published in May this year by the Imperial Economic Committee. Copies may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, at one shilling net. The following extracts are reprinted from the Introduction to the report.—(Ed.).

It is impossible to estimate with any degree of accuracy the world's population of cattle, sheep and pigs, for in many areas, and these not the least important, the figures are either incomplete or entirely lacking. At a rough estimate, the total number of cattle may be in the region of 600 millions, of which about two-fifths are in the British Empire; sheep may number about 750 millions, with between one-third and two-fifths in the Empire and pigs not quite 300 millions, of which not more than 5 per cent. are in Empire countries.

In countries where reliable data are available and which figure in international trade for meat products it would appear that cattle numbers have tended to decline since 1925. On the other hand, the sheep and pig populations in these countries have expanded during the same period.

The Trend of Production and Consumption.—Livestock numbers do not afford a reliable indication of meat production, due largely to the different purposes for which the animals may be kept. Cattle may be intended primarily for milk production or for draught purposes and in the largest sheep-raising countries wool is of more importance than mutton. India, with more than one-quarter of the world's cattle population, does not figure as an important beef-producing country.

As in the case of livestock numbers, figures of slaughtering are not available for the world as a whole, nor for more than some of the countries which share the international trade in meat. From the estimates available it seems clear

that beef production in the principal producing countries declined between 1925 and 1931, but that some recovery has since occurred. Cattle slaughterings in Europe increased during these years, but imports were drastically reduced, while the trend of production was downward in the exporting countries of South America and the United States. Slaughterings of sheep for the production of mutton and lamb, in the main countries concerned, have expanded throughout this period both in the world as a whole (excluding Russia) and in Empire countries. Pigmeat production has also increased, particularly in Europe, a feature reflected in the rising shipments of bacon to the United Kingdom. But by 1933 the output was beginning to decline in exporting countries. A further fall probably occurred in 1934 and the recent drastic reduction in the United States pig population will be sufficient to affect even the total world production of pigmeat during the current year.

It is evident that there has been a downward trend in beef consumption and a change over to mutton and pork in recent years, both in countries which normally consume more beef than pork and in those where pork is the more popular meat, chiefly North America, Germany and some northern European countries. Between 1925 and 1932, beef and veal consumption in the United States fell from 71 to 54 lb. per head, while pork rose from 68 to 72 lb. and mutton and lamb from 5 to 7 lb. In Germany, *per caput* beef and veal consumption in the same period fell from 38 to 37 lb., while pork rose from 57 to 68 lb. In Great Britain, between 1925 and 1932, beef and veal consumption is estimated to have declined from 70.5 to 62.5 lb. per head, and pigmeat and mutton to have risen respectively from 43 to 51 lb. and from 26 to 32 lb. Nevertheless, it appears that, in some countries at least, these tendencies were reversed in 1933. In Great Britain, for example, beef and veal consumption in 1933 increased to 64.5 lb. per head, pigmeat decreased to 45.5 lb. and mutton and lamb remained about the same at 32.5 lb.; there is little doubt that beef again increased in 1934, while pigmeat declined further.

There are striking contrasts in the apparent consumption of meat per head in various countries, although the figures

are available in only a few cases. The peoples of New Zealand, Australia and Argentina are large meat eaters, mainly beef in the last-named and both beef and mutton in the first two, the total in each country being well over 200 lb. of meat per head. In Great Britain, the United States and Canada the *per caput* consumption averages about 150 lb., of which pork accounts for 80 lb. and beef for about 60 lb. in the case of the two last-named, while in Great Britain beef accounts for about 65 lb., pork for under 50 lb. and mutton for 30 lb. Germany eats more pork than beef, France more beef than pork and neither any material amount of mutton, their aggregate consumption of all meats being approximately 110 and 90 lb. per head respectively.

The consumption of meat as a whole appears to have declined slightly in many countries during the past decade.

International Trade in Meat.—International trade in beef and mutton is largely a movement from the Southern to the Northern Hemisphere, while world trade in pigmeat is mainly confined to the Northern Hemisphere. There is a substantial trade in livestock among European countries, the most notable example being the movement from Ireland to Great Britain.

A few countries together account for the greater part of the meat entering world trade. Argentina is by far the principal exporter of beef, with Australia occupying second place, although the meat equivalent of the Irish Free State exports of live cattle would place that country before Australia; then follow Uruguay and New Zealand, the latter having lately displaced Brazil. New Zealand is the principal exporting country for mutton and lamb, while in the past two years Australia has superseded Argentina in second place. Denmark exports considerably more pigmeat than any other country and the Empire's share in the export trade is very small. The Empire figures as a net importer of all meats, due to the large import demand of the United Kingdom, but the import balance has tended to diminish within the past few years.

Between 1928 and 1933 exports of chilled and frozen beef and veal from the eight most important exporting countries declined by 23 per cent.; exports of mutton and lamb from the five most important countries increased by 56 per cent. in

the same period, exports of bacon and hams from twelve countries decreased by 3 per cent., exports of pork from ten countries declined by 30 per cent. and exports of canned meat from six countries declined by 8 per cent.

Importance of Meat in National Exports.—In most countries, meat production is primarily for domestic consumption. Uruguay until recently apparently exported more than half of its beef and mutton production, but the proportion, particularly of mutton, has declined considerably. New Zealand's export of mutton and lamb and Denmark's exports of bacon constitute the greater part of their annual output of these meats. The cattle exports from the Irish Free State represent a much greater meat production than the annual supply of beef for home use. But in other countries significant in world trade the home market provides a larger outlet than is afforded by exports.

In very few countries, too, do meat or live animals comprise a very substantial part of the total export trade. Bacon in Denmark and live cattle in the Irish Free State represent about 30 per cent. of the total export trade in each case, while mutton and lamb represent about 20 per cent. of New Zealand's total exports. Chilled and frozen beef in 1933 formed only 11 per cent. of Argentina's total exports and 12 per cent. of those of Uruguay. Livestock (except horses) and all meat combined represented about half of the export trade of the Irish Free State in 1933, 42 per cent. of the exports of Denmark, 28 per cent. of those of Uruguay and 25 per cent. of those of New Zealand. But only 16 per cent. of Argentina's exports and less than 6 per cent. of those of Australia were represented by meat and live animals.

Beef.—International trade in beef has declined materially since the post-war expansion, when European countries were rebuilding their depleted herds. Aggregate exports from the principal countries in 1933 were 9 per cent. smaller than in 1932. There was probably a further fall in 1934, when exports from Argentina, by far the greatest exporter, were slightly less than in 1933 and 25 per cent. below the figure for 1928. Between 1928 and 1933, exports from Uruguay were reduced by 21 per cent., and exports from Brazil, despite an expansion in intervening years, declined by 36 per cent.

The United Kingdom is easily the principal importing country for beef and veal and, despite a downward trend in imports, has taken an expanding share of world exports. In 1933, the United Kingdom accounted for 84 per cent. of the imports into the eight principal importing countries, compared with only 72 per cent. of the same countries' imports in 1928. The United Kingdom is practically the only market for chilled beef. European countries formerly absorbed a fair proportion of the exports of frozen beef, but owing to tariffs and import restrictions these markets have dwindled to minor significance; Italy, France, and Belgium combined imported less than 2 million cwts. of beef and veal in 1933 and 1934, compared with over 4 million cwts. in 1928. This fact, lately combined with the incidence of United Kingdom restrictions, has caused a greater decline in frozen than in chilled beef exports in recent years. United Kingdom imports of frozen beef increased between 1932 and 1933, while imports of chilled beef declined; these movements were reversed in each case in 1934. The Empire share in the beef imports of the United Kingdom, which fell from 13.4 per cent. to 10 per cent. between 1926 and 1930, increased to 24.5 per cent. in 1934. These figures exclude meat from live cattle, which declined substantially in 1934. Home-produced beef and veal in 1933 comprised nearly 46 per cent. of total British supplies, a higher percentage than in either of the two preceding years, but one which was undoubtedly surpassed in 1934.

A recent feature of the beef trade has been the successful inauguration of chilled beef exports from Empire countries. Prior to 1932 this trade was negligible, but shipments approached a quarter of a million cwts. in 1934, Canada, South Africa, Southern Rhodesia, Australia and New Zealand all participating—total United Kingdom imports of chilled beef in that year were $8\frac{1}{4}$ million cwts.

Mutton and Lamb.—There has been an appreciable expansion in world trade in mutton and lamb in the past decade. Exports from the principal countries between 1926 and 1931, the peak year, increased by 37 per cent. A decrease has since occurred, exports in 1933 being 5 per cent. less than in 1932, and a further decline occurred in 1934, equal to 8 per cent. on the 1932 total.

New Zealand is by far the most important exporter of mutton and lamb and shipments increased by 1 million cwts., or 35 per cent., between 1928 and 1933, although they were somewhat reduced in 1934. Exports from Australia have almost trebled in the same period and have enabled that country to surpass Argentina, whose exports, as those of Uruguay, have declined. During the last few years there has been a tendency in New Zealand for the proportion of lamb exported to increase in relation to mutton.

The United Kingdom takes the greater proportion of mutton and lamb entering world trade. Imports into Continental countries are very small, the most important being France. Of imports into five importing countries, the United Kingdom has accounted for over 95 per cent. in recent years. The proportion of lamb in the combined imports of mutton and lamb has grown from 59 per cent. in 1928 to 75 per cent. in 1934. The Empire's share of United Kingdom imports in 1934 was 80 per cent., compared with 60 per cent. in 1928. About 46 per cent. of total British supplies of mutton and lamb in 1933 were home-produced and this proportion may have shown little change in 1934.

Pig Meat.—International trade in pig meat is dominated by the movement of bacon and hams to the United Kingdom. This trade showed a material expansion between 1926 and 1932, when exports from the principal countries increased by 32 per cent. Voluntary restrictions followed by a more permanent scheme of import control caused a considerable reduction in exports, best seen in imports into the United Kingdom, which declined by 18 per cent. between 1932 and 1933 and by a further 16 per cent. in 1934. The main feature of the trade during the past decade has been the development of imports from European countries and the decline in supplies from the United States. Denmark supplied 56 per cent. of all the bacon imported in 1934; the United States is still the principal source of the much smaller imports of hams and accounted for two-thirds of the imports last year. The Empire share of United Kingdom imports of bacon and hams had been declining for a number of years and comprised under 5 per cent. in 1932, against over 20 per cent. in 1925. Since then the proportion has risen substantially, due chiefly to expand-

ing imports from Canada, as provided under the Ottawa Agreement; in 1934, Empire supplies accounted for 17 per cent. of the total.

Trade for pork declined, following the United Kingdom embargo on Continental fresh meat in 1926, and has since fluctuated, growing imports into the United Kingdom being offset by a downward trend of supplies into Germany and France. Imports of fresh, frozen and salted pork into the United Kingdom in 1934 were 90 per cent. greater than in 1928. The Empire share has decreased, due largely to the fall in imports of Irish Free State fresh pork. A feature has been the development of a trade in frozen pork from the Southern Dominions, especially New Zealand.

Home-produced pig meat in 1933 accounted for 39 per cent. of total supplies, compared with an average of about 35 per cent. in the preceding five years. There is little doubt that the proportion increased substantially in 1934.

Canned Meat.—South American countries are the principal exporters of canned meat and the trade has declined since 1929. The United Kingdom, the largest importer, derives the bulk of its supplies from foreign countries, Empire supplies accounting, on the average, for under 5 per cent.; total imports have declined since 1930. The United States is also a large importer of canned meat, taking 800,000 cwts. in 1929, but imports have been on a much lower level in subsequent years.

Prices.—Prices of meat, as of agricultural products generally, have declined in the United Kingdom since 1930. Beef prices, however, withstood the depression rather longer and better than those of many other products. A fall occurred in 1931, however, which was greatest for frozen beef and least marked for fresh. The fall continued in the two following years, in spite of import restrictions, and even in 1934 each category averaged slightly lower than in 1933. Between 1930 and 1934 wholesale prices for fresh beef declined by about 21 per cent., chilled beef by 22 per cent., and frozen by 37 per cent. The British agricultural index number for fat cattle in 1934, including subsidy payments, was 104 (1911—13=100), compared with 133 in 1930.

Prices of mutton and lamb fell to a much greater extent than did beef between 1930 and 1932, but recovered appreciably in the two subsequent years. Between 1930 and 1934 English wholesale mutton prices declined by 21 per cent., New Zealand mutton by 13 per cent., and both British and New Zealand lamb by 18 per cent. The agricultural index for fat sheep was 127 in 1934 and 160 in 1930.

Pigmeat supplies and prices show a much greater variation than those of other meats. There was a very substantial decline in bacon prices between 1930 and 1932, when production in many European countries reached a cyclical peak. The restriction of imports arranged at the end of 1932 was followed by a marked price recovery in the two following years and by 1934 imported bacon prices were almost back to the 1930 level; home-produced bacon also recovered, but remained considerably under the 1930 average. Quotations for home and imported pork also declined substantially between 1930 and 1932 and have since increased, but the recovery has been much less marked than in the case of bacon. The agricultural index number for baconer pigs, which in 1930 was 153, fell to 112 in 1934 and porkers declined from 165 to 120 in the same period.

Civilization and Soil Erosion.

By W. C. LOWDERMILK,

Soil Conservation Service, U.S. Department of Agriculture.

Extract from *Journal of Forestry*, June, 1935.

Civilizations have risen and fallen since the dawn of history. The Chinese alone are unique in that they date their beginnings in legendary antiquity and have continued as a civilization in an unbroken line to the present day. Not until recent years, beginning with George Marsh, has an inquiry been seriously made as to the part that mismanagement of soil has played in the decline or the destruction of civilization, and the inter-relation between civilization and erosion.

Present-day archæologists, in their post-mortems on excavations of ruins of ancient civilization, have revealed some very illuminating information. They now tell us that some former civilizations, once revelling in a Golden Age of prosperity and surrounded by magnificence and opulence, are crumbled in ruins, half buried in the dust and debris of their own destructive exploitation of the lands they once cultivated. Expeditions of the writer into northwest China revealed that it was the destructive handwork of man more than climatic changes which reduced those once prosperous and rich regions to a land of poverty and decadence.

Aerial photographs of ruins in Asia Minor, Palestine, North Africa, and Peru are strikingly similar. All such ruins are in the regions of scarce vegetation, bare hillsides, and rock lowlands. History tells of vast armies surging back and forth across these regions. They must have been entirely dependent for food upon the surrounding country. Yet, now those barren, dry lands scarcely sustain the scattered native populations.

The great despoiler of civilizations and landscapes is soil erosion, by wind and water. It is a disease which has followed

mankind throughout the centuries in his exploitation and destructive treatment of the good earth from which he received his sustenance—a disease, difficult to discern at first and responsive to treatment in the early stages, but absolutely fatal to civilizations in its final stages.

As the civilizations increased in population the crop demands upon the surrounding lands became greater. In the arid regions, enlarged herds overgrazed their hill lands, destroying the vegetative cover and grinding with their hoofs the ground to powder. The exposed soils in dry seasons were swept aloft and blown by the wind and in rainy seasons were washed down the slopes by torrential flows to ruin the fertility of the lowlands. Cooke believes that the Maya civilization had to migrate because it was choked to death by mud washed from its own hillside corn patches. Palestine and north China cut off their forests as the increased demand for food required the cultivation of the slopes. According to the steepness of the slopes, the rich humus soil which had been centuries in the making washed off in from three to twenty years, leaving the land sterile, rocky and bare, unprotected, and each rain dumped debris on the fertile lowlands or choked the irrigation canals and rivers with silt.

This accelerated erosion as an enemy of civilization is not the geologic erosion which slowly cut through rock formations, rounded off the hills and filled in the valleys, and carved, like slow moving glaciers, the grandeur of canyons and gorges. But this geologic erosion does act as a measuring stick to show the rapidity of accelerated or man-induced erosion.

No nation in the history of the world has gone at the destructive exploitation of its natural resources with the rapidity and thoroughness that we have here in the United States. Coming events cast their shadows before them. Therefore, if we as a civilization are to be saved from the fate of some of these former decadent and fallen civilizations, it is imperative that we launch a co-ordinated land-planning programme for the conservation of our forests, agricultural and range lands, and our water resources.

The Physical Crisis of Land Use.—The present physical crisis in land use within the United States is a consequence

of the period of exploitation in the rapid occupation of the North American continent by the American people. The time when worn out land can be abandoned for virgin soils lying to the West, with their stored fertility, is gone. Practically all the lands of the country best suited to agriculture have now been occupied. The old agricultural frontier has dissolved into the Pacific; the new frontier has reappeared under foot on the farms now under cultivation. In like manner, the forest frontier is being destroyed. The fundamental problems of land use now reside in the conservation of soil, forest, and water resources and in intelligent soil and forest, range, and farm management.

A brief review of the course of occupation of the American continent aids in clarifying certain problems of present land use and in forecasting some of the exigencies of a future soil-conservation and land-use programme so vitally essential to sustained use of our land and forest resources.

Except in an insignificant way, the aborigines of North America had done little to cultivate the soil or to change the virgin character of the land surface and its vegetation. The coverage of vegetation and the soil protected by it were natural responses to long processes of soil and plant development under favourable climates. The streams bore oceanward the residue of precipitation waters that flowed gently from sloping areas and nourished vast unbroken stands of vegetation. Rivers draining the regions covered with dense vegetation generally ran clear except in high flood, when channel erosion furnished the major burden of silt. This channel erosion generated soil creep from vegetated slopes and in addition to the processes of solution, served to sculpture and wear down the land with the leisure of geologic processes. Moreover, where comparatively rapid differential land uplift through deep-seated geological processes had occurred or within climatic zones too rigorous or too arid to support an unbroken cover of vegetation, storm waters carried substantial quantities of silt and eroded debris into drainage streams. Processes affecting the land proceeded in these instances at more rapid rates; streams ran muddy throughout most of the year, as in the instances of the Missouri and Colorado.

In the broad expanses of the country, from semi-tropical to boreal climates, from humid to arid conditions, there spread before the eager colonists an infinite variety of conditions. By far the larger area was completely covered with vegetation, ranging from grasses to dense forests. Such coverage had, in the long period of interdependence of soil formation and vegetative succession, protected the land surface from rain-wash and wind blast and favoured a ready absorption of rain and melting snow by deep soils, honeycombed by the burrowing of insects and plant roots and otherwise made porous by natural process of soil development. Little surface washing occurred. Certainly the processes of erosion, which may be designated under these circumstances as geologic norms of erosion or normal erosion, had not proceeded at rates in excess of soil formation from the materials of the substratum; for beneath the mantle of vegetation lay the nourishing soils of varying depths, the products of intricate process of soil formation over incalculable periods of time. This fact is of highest importance in considering problems affecting long-time planning in land use. Soil erosion had not exceeded soil formation from beneath, under the natural conditions obtaining prior to the "agricultural conquest" of the forested and grass-covered lands of the nation.

Into this pristine continent entered the colonists with a burst of energy that began a transformation of the land at a rate probably never before occurring in the history of any nation, and with it the creation of fabulous wealth. There were reservoirs of populations in Europe which supplied, in a comparatively short time, millions of vigorous people to clear away the forests and to cultivate the soil as the agricultural and forest frontier was rapidly pushed westward. It was no steady infiltration into undeveloped regions, but a rapid advance over a wide front by farmers, lumbermen, and stockmen with their ploughs, axes, and herds. Frontiers were pushed farther and farther westward at a pace that eliminated planning or even thought of the effect of man's activities upon the abundant natural resources that everywhere swept away to the horizon. Man was busy clearing the land of forests, "subdueing the wilderness," slaughtering the buffalo for their hides, and breaking out first the sod of the prairies and then

the short grass of the plains on the west. In his eagerness, the settler lost sight of any need for conservation and failed to sense his stewardship of the new-found continent.

Withal, it is only necessary here to call attention to the significant changes in rate of erosional processes occasioned by the clearing and burning of forests and other vegetation, the breaking of the soil with ploughs, and the heavy consumption of the forage herbage by rapidly multiplying herds. Soils which had been thoroughly protected through thousands of years of time by unbroken mantles of vegetation, and, for this reason, had weathered to fine textures with high organic contents so favourable to "mellowness" and good fertility, were suddenly exposed to the dash of torrential rains characterising the climate of extensive regions. There began under these conditions a rate of soil erosion greatly in excess of the rates that hitherto obtained. The significant fact of this period of indifferent land use, still continuing over an expanding area, is that the rates of soil removed by rainwash greatly exceeded, and still do exceed, the rates of soil formation over vast areas—a sure process of land destruction. Topsoils have been literally washed away, leaving raw, comparatively unproductive, unabsorptive, intractible subsoil exposed at the surface, broad instances of which condition are conspicuous throughout the major agricultural soil provinces of the nation—as the Piedmont Plateau, the areas of rolling glacial and loessial soils, much of the Atlantic and Gulf Upper Coastal plains province, the Great Plains region, and the greater part of the crop and grazing areas of the West. Moreover, concentration of runoff has removed the topsoil and cut enormous gullies deep into the underlying subsoil materials, from which true production topsoil is formed only through ages of natural processing. These gullies are cutting headward and laterally into valuable farms and forests, discharging with maximum speed the concentrated rainfall descending from the upper watersheds into drainageways and upon valley lands. So malignant and ruthless has been the work of accelerated erosions that the productivity of millions of acres of rich, virgin farm land in densely populated regions of the United States has been destroyed within less than a century.

The Report of the Chief Entomologist

FOR THE YEAR ENDING 31st DECEMBER, 1934.

By R. W. JACK, Chief Entomologist.

AGRICULTURAL.

Pressure of work due to administrative duties and the locust invasion has continued to prevent sufficient attention being devoted to pests which come under the above heading.

The locust invasion has, of course, overshadowed all other pests of agriculture during the year.

Locusts.—The preparation and distribution of monthly reports concerning the locust invasion make it unnecessary to give more than a brief resumé in the Annual Report.

Both the Red Locust (*Nomadacris septemfasciata* Serv.) and the Tropical Migratory Locust (*Locusta migratoria migratorioides* Rch. and Frm.) have been present in the Colony, but the latter species has been of comparatively little importance.

The hopper outbreak in the 1933-34 season was found to be of exceptional magnitude, every district in the Colony being infested. A vigorous campaign was waged in which 212 tons of arsenite of soda powder, 6,000 gallons of cattle dip and about 7,000 locust spray pumps were used. As a result of this campaign practically the whole of the European maize crop was saved and the aggregate reaped was fully up to the normal. Native crops suffered to a considerable extent in some districts, mainly, but far from exclusively, from winged swarms. The eastern border, especially, was subjected to repeated visitations by flying swarms throughout the year.

The Locust Fungus (*Empusa grylli*) appeared in late March and April, attacking large hoppers and adults. The disease died down during May, but was again active on the eastern border and in Portuguese territory during June and

early July. At this time it appeared that the locust position in the Colony might have improved. The position commenced to change for the worse, however, in August, when a number of very large swarms invaded the Colony from Northern Rhodesia. This invasion continued through September and October, and finally in November, the Colony suffered a further invasion on an unprecedented scale from the North. This was apparently the true pre-breeding southward migration of swarms over-wintering in Angola and elsewhere in Central Africa. The whole Colony was over-run by vast swarms of the Red Locust, including in some districts a small proportion of the Tropical Migratory species. This great invasion extended into the Union of South Africa.

Egg-laying occurred in most districts during November and December and hoppers were reported in fourteen districts by the end of the year.

Whilst the magnitude of the hopper outbreak for the season 1934-35 is still uncertain, it is clear that it will not be fully commensurate with the magnitude of the invasion by fliers. During November and December a parasitic fly was found to be very prevalent and very large numbers of locusts perished from this parasite. Rains were also early and persistent and the locust fungus (*Empusa grylli*) put in an appearance to such effect that whole swarms are reported to have died in most parts of the Colony. Comparatively few active swarms appear to have survived to the end of the year. The point now in doubt is the extent to which eggs were laid before the majority of the locusts perished.

Experiments with Dusting Locusts from Aeroplanes.—During the period 24th May to 23rd June the Division collaborated with Mr. H. H. King in certain experiments concerning the possibilities of destroying locust swarms, whilst in flight, by dusting with arsenite of soda powder from the air. The results have been fully reported by Mr. King to the Committee on Locust Control of the Economic Advisory Council in Great Britain, and a report has appeared in print.

Locust Investigations.—Some progress has been made during the year in studying the bionomics of the Red Locust and experiments have been made with various methods of control, including the use of poison baits and barriers.

A few preliminary laboratory experiments were made late in the year testing the effect of certain non-poisonous contact sprays against locusts. A small series of laboratory experiments was also carried out in December to ascertain the concentration of chlorine gas and length of exposure necessary to kill adults of the Red Locust.

Insects Associated with Locusts.—The following insects have been associated with Red Locusts during the year: the Phorid, *Pulicophora rhodesiana*, Schmitz, was bred from the larval stage in decomposing egg pods. Six species of Diptera were bred from the larval stage in decomposing adult locusts, namely, the Phorid, *Diploneura armipes*, Bruss, the Muscids, *Fannia canicularis*, L., and *Muscina stabulans*, Flin., and the Sacrophagids, *Sacrophaga beckeri*, Vill., *S. exuberans*, Pand., *S. nodosa*, Engel, and *S. villa*, Curran. Two insect species were found destroying eggs; the egg-maggot, *Stomorhyna lunata*, F. was a fairly common egg predator, and the Hymenopterous egg parasite, *Scelio howardi*, Grant, was found on one farm.

The Tachinid parasite of the adult locust mentioned in my report for last year has not yet been identified. This insect continued to be evident during the early part of the year, and thereafter was found parasitising the later stage hoppers. The larva has a conspicuous chitinized anal segment bearing the posterior spiracles. Towards the close of the year this insect became very abundant in Red Locust adults, and was frequently reported from many parts of the Colony.

Pests of Stored Products.—(a) *Tobacco.*—The presence of the Stored Tobacco Worm (*Ephestia elutella*, Hübner) was discovered in one country warehouse. Suspicion had been attached to this warehouse for two years and frequent inspections had been made. Steps were taken to clear up the premises and all suspected tobacco was fumigated under the supervision of this Division before its removal was permitted. The one infested factory in the Salisbury district mentioned in my last report is still infested, but owing to the erection of additional modern storage space there is now much less likelihood of escape from these premises.

Evidence of nine minor infestations of the Tobacco Beetle (*Lasioderma serricornis*, Fab.) was found in town and country

premises. In all cases the infestations were traceable to the storage of tobacco through at least one summer season. The infested tobacco was destroyed.

Reports from London indicated that Southern Rhodesian tobacco has practically all arrived in clean condition during the year. Towards the end of the year the Imperial College of Science, London, obtained evidence indicating risk of infestation of tobacco with *E. elutella* on board ship, possibly due to the insect breeding in maize meal, a product which, however, has not yet been recorded as infested with this species on a spontaneous basis. The moth is, however, reported to breed freely in this medium in the laboratory.

In May an Entomologist visited the port of Beira and inspected conditions there with the result that no evidence was obtained of any infestation of the sheds and vicinity.

(b) *Maize*.—As the presence of weevil (*Calandra oryzae*, L.) in maize intended for export has caused considerable inconvenience and monetary loss in marketing the crop in the past, the Rhodesian Agricultural Union at the annual Congress requested the Department to make a special study of the pest. One official of the technical staff has therefore been detailed to devote most of his attention to the study of the problem of stored products insects in general and maize weevil in particular.

(c) *Stored Products in General*.—A survey of the pests of stored products was carried out in the mills, warehouses, factories and stores in Salisbury in July. Most of the species found were well known cosmopolitan pests such as the Fig and Date Moth (*Ephestia cautella*, Wlk.), the Mediterranean Flour Moth (*E. kuhniella*, Zell.) and the Indian Meal Moth (*Plodia interpunctella*, Hubn.), etc. No Stored Tobacco Worms (*E. elutella*, Hubn.) were discovered. A beetle (*Alphitobius* (?) *piceus*, Ol.) was found in a maize bin in a local flour mill.

(d) *Imported Timber*.—An imported Scolytid beetle (*Gnathotricus materiarius*, Fitch) was found dead in Canadian spruce.

Pests of Growing Tobacco.—(a) *Root Gallworm* (*Heterodera marioni*, Goodey).—A number of growers reported root gall-

worm as being unusually severe during the growing season. The rotation experiments in connection with this pest are continuing.

(b) *Tobacco Whitefly* (*Fam. Aleyrodidae*).—Greater thoroughness in cleaning up tobacco lands during the winter by removing both stalks and roots has resulted in an improvement in the position as regards this pest. Growers are now tending to regard the volunteer tobacco plant as a noxious weed, with the result that tobacco lands, old seed-beds, etc., are noticeably cleaner than heretofore. A neglected land can become a menace to many other lands in the neighbourhood, the infestation and resulting incidence of leaf curl disease diminishing with the increase of distance from the sources of infestation.

(c) *Other Pests of Tobacco*.—Small black ants (*Pheidole sp.*) caused considerable damage to some Turkish tobacco seed-beds early in the year by carrying away the germinating seeds. Virginia tobacco seed-beds suffered similarly in October. Leaf Miner (*Phthorimaea operculella*, Zell.) and Stem Borer (*P. heliopa*, Lw.) were found as usual in the field.

Pests of Citrus.—The attack of the Cotton Bollworm (*Heliothis absoleta*, F.) on citrus was heavier than usual, possibly owing to the mild condition prevailing during the winter months. Some damage was incurred, but it was not nearly as extensive as that caused in 1932.

The Citrus Aphis (*A. tavaresi*, Del G.) and the Citrus Thripe (*Scirtothrips aurentii*, Faure) were of very little importance and the usual control measures (*i.e.*, spraying with lime-sulphur and nicotine) safeguarded the crop satisfactorily.

Flying swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) attacked the trees at the time of blossoming, and in some localities serious damage was done.

The Pentatomid bug (*Agonascelis erosa*, Westw.) caused slight injury to twigs in Gatooma.

Most of the above information was kindly supplied by the Director of the British South Africa Company's Citrus Experiment Station at Mazoe.

Pests of Cotton.—American Bollworm (*Heliothis obsoleta*, F.) was of about average intensity at Gatooma, but more serious in the Mazoe and Lomagundi districts, especially on late planted cotton. Most boll punctures were made by this species. In Gatooma the eggs were parasitised by *Trichogramma lutea*, Gir. to the extent of about 30 to 50 per cent. In addition, there was a fair percentage of egg destruction by *Orius* (*Triphlelds*) sp. and other predators.

Sudan Bollworm (*Diparopsis castenea*, Hmp.) damage was serious during the latter part of the season and has become progressively worse during the past few years at Gatooma. Experiments with periodically stripped (every two or three weeks) standover cotton traps to attract the early season moths are promising.

Stainers (*Dysdercus* spp.) were responsible for a fair amount of damage, but less so than the American Bollworm. They were most abundant in the Sabi Valley, where there are more natural host plants than elsewhere. Seed cotton traps proved useful in Gatooma in the early part of the season, but attracted actually fewer stainers after February when the stainer population was larger.

Jassid (*Empoasca fascialis*, Jac.) attack was more serious than usual.

Aphis (*Aphis gossypii*, Glov.) was less troublesome than usual at Gatooma, being heaviest during a somewhat drought-stricken period in late February and early March.

The above information was kindly supplied through Major Cameron, Cotton Specialist, Empire Cotton Growing Corporation, by Mr. J. E. Peat, of the Corporation's Station at Gatooma.

Pests of Growing Maize.—Damage by the Maize Stalk Borer (*Busseola fusca*, Full.) was lighter in the 1933-34 crop than in recent years, particularly in the Salisbury district. Considerable injury, however, was sustained by maize and sunn hemp in this district from the attacks of leaf-eating beetles, including *Cantharis brevipennis*, Haag. and *Euxora discoidalis*, Jac. The Snout Beetle (*Tenymecus destructor*, Mshll.) was abundant during December.

Outbreaks of white grubs (*Eulepida mashona*, Arrow) which have been recorded in previous Annual Reports as occurring in the Victoria and Enterprise districts, have continued to cause this Branch much concern, but it has not been possible to give the problem the attention it deserves.

Pests of Other Cereals.—Considerable damage to wheat and barley by the caterpillar of the moth *Cirphis loreyi*, Dup. (Noctuidæ) was reported from the Shamva and Umtali areas. In one locality the larvæ were parasitised to an extent of over ten per cent. by three species of Tachinid flies, including *Sturmia laxa*, Curran. In the Eastern districts, greenfly, mostly *Aphis maidis*, Fitch and *Taxoptera graminum*, Rond., were responsible for much injury to young wheat and barley during April and June.

Pests of Vegetables and Garden Plants.—In June and October severe injury to onions by a yellow thripe, as yet undetermined, was reported in the Eastern districts. In the Victoria district *Aphis laburni*, Kalt. was found damaging Madagascar butter beans in July. Gladiolus plants were severely infested by the Chloropid stem-borer, *Epimadiza hirta*, Mall., from September to November in various districts. Flowering stems of Gladiolus were damaged by the Sphegid Wasp, *Dasyproctus bipunctatus*, Lep., which bores into the stem and provisions the resulting nest with Muscid flies (*M. interrupta*, Wlk.). The lady-bird beetle, *Epilachna vigintipunctata*, Muls., was a serious pest of Barberton daisies during November and December.

Pests of Fruit Other than Citrus.—The spread of the White Mango Scale, *Aulacaspis cinnamoni*, Newst., in the Umtali township is causing alarm, and the Municipality is taking steps to effect some measure of control. In Gatooma slight injury to mango twigs by the Pentatomid bug, *Agonocelis puberula*, Stål., is reported. Apple blossoms were damaged in November by the chafer beetle, *Schizonycha manica*, Per., at Norton. The fig weevil, *Omophorus stomachosus*, Boh., was unusually troublesome in cultivated figs in the Bulawayo district.

Miscellaneous Insect Records.—The following insects and their host-plants are worthy of record. Some of these records

are the result of observations made during the year, others the result of earlier observations when no authentic names were available.

- (1) The Chrysomelid, *Malesoma quadriliniata*, Jac., the larvæ of which feed on and disfigure young leaves of Msasa trees (*Brachystegia randii*) in spring;
- (2) The Bruchids, *Bruchus submaculatus*, Fahs. and *B. signatopygus*, Pic., from seeds of *Acacia* near *pennata*;
- (3) The Bruchid, *B. baudoni*, Caill., from seeds of *Acacia giraffæ*;
- (4) The Cerambycid, *Enaretta castelnaudi*, Thoms., from pods of *Cassia didymobotrya*;
- (5) The blue butterfly, *Argiolaus trimeni*, Wallgrn., the larva of which was found feeding on mistletoe (*Loranthus* sp.);
- (6) The Noctuid, *Mesogenea varians*, Hmp., which occasionally appears in great numbers for a few days in Mashonaland during September and October, has now been found to breed on Msasa (*Brachystegia randii*);
- (7) The fruit fly, *Urophora agromyzella*, Bezzi, infests the inflorescence of *Vernonia amygdalina* (Compositæ);
- (8) The Whitefly, *Trialetrodes mossopi*, Corb., infests different varieties of beans, especially haricot beans, in sheltered places during the winter, and is lightly parasitized by a species of *Prospaltella*. This species is referred to as the "Common Whitefly" in the *Rhodesia Agricultural Journal*, November, 1932;
- (9) The Noctuid, *Laphygma leucophlebia*, Hmps., of which the larvæ damage very young tobacco seedlings. This species is referred to under "Pests of Tobacco" in my Annual Report for 1932 as "an unidentified Noctuid caterpillar";
- (10) Two species of Lepidoptera emerged from a "nest" of web and leaves built in a *Cassia goravensis* bush,

viz., the Lasiocampid, *Diapalpus congregarius*, Strand, and the Pyralid, *Paraglossa mauritalis*, Guen;

- (11) The Eumolpid (Chrysomelid), *Colasposoma amplicolle*, Lef. damaging tops of young cypress (*Cupressus lusitanica*) and eucalyptus (*Eucalyptus* sp.);
- (12) The Pentatomid, *Gonioscelis versicolor*, F., which caused extensive dropping off of citrus fruits in the Bulawayo district;
- (13) The Membracid, *Xiphistes fuscicornis*, Germ., sucking the stems of kudzu vine (*Pueraria thunbergiana*) and attended by *Plagiolepis* ants, at Glendale;
- (14) The Tettigometrid (Homop.) the nymphs of which feed on citrus leaves and are attended by the ant *Plagiolepis custodiens*, Sm.

MEDICAL AND VETERINARY.

Tsetse Fly.

Continued operations against game and tsetse have resulted in considerable further progress during the year, particularly in the Lomagundi, Hartley and Darwin districts. This is emphasised by the fact that not a single case of trypanosomiasis has been recorded during the year in the formerly affected areas in Sipolilo, Lomagundi (Doma), Lomagundi S.W. and Darwin, whilst in the Gatooma area the position in reference to cattle on the farms is greatly improved, although a few cases occurred on two farms on and near the Rob's Drift Road, which leads out of the fly area.

The periodical surveys of the areas of operation have revealed continued diminution and retrogression of fly in Sipolilo, Lomagundi S.W. and Gatooma, whilst the fenced area in Lomagundi (Doma) remains practically free from fly, only odd specimens being seen very occasionally at the northern fence. Even the difficult Gatooma area has at last yielded to such an extent that only single flies are now to be met with in the fenced zone.

Whilst the object of the operations is defence rather than reclamation of tsetse infested country, the attempt in certain

areas to put a greater distance between the fly limit and the occupied country has now resulted in about 1,900 square miles of country being cleared of the pest or reduced to the "occasional fly" condition. This is made up as follows:— Sipolilo, 400 sq. miles; Lomagundi (Doma), 600 sq. miles; Lomagundi (Urungwe) adjacent to Angwa River 100 sq. miles; Lomagundi (S.W.), 300 sq. miles; Gatooma sub-district, 500 sq. miles.

On the other hand progress in the Gwaai-Shangani region is proving slow, as was anticipated from (1) the very high density attained by the fly before the operations were commenced in earnest, and (2) the great attractiveness of this region to game. The density of the fly has, however, decreased appreciably in the region of the Gwaai River and the westward spread of the pest has been arrested. All operations undertaken in heavily infested fly country to date have experienced a critical period during which the benefit has not been obvious, but the eventual result in the case of older areas has been satisfactory. It is to be borne in mind that the fly has been driven back in this region in the past (1919-1922), although its distribution at that time was more limited and its density between the Gwaai-Shangani Rivers very much lower.

The position in the Urungwe Native Reserve and neighbouring country is, at present, unsatisfactory. It was anticipated that loss of further ground to the fly would probably be unavoidable in this area, due to the very difficult nature of the country in the western half of the reserve and thence to the Sanyati River. This country is very broken and deficient in permanent water. It is the haunt of rhinoceros and elephant, which it had been judged desirable not to attempt to destroy if it could be avoided. Fly has apparently increased in the valley, where no effective operations have been possible, and wandering flies are now to be met with over the whole of the western half of the reserve. Cattle have also been infected further afield, even on one farm in European occupation. Such cases are possibly due to transported flies. It is to be realised that in order to protect any given area it is necessary to interpose a wide fly-free buffer zone between that area and the main fly belt, and that, in this locality, the nature of the ground militates against effective procedure on these lines.

It will be noted from the section dealing with the Melsetter border clearing, that indications are at present favourable to a large degree of success attending this undertaking.

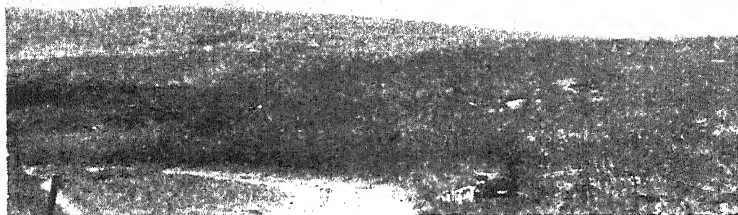
On the whole, with the exception of the section including and near the Urungwe Native Reserve, the tsetse fly position throughout the Colony may be regarded as under control, whilst extensive areas in the more important districts which were formerly seriously affected, have now been rendered reasonably safe for livestock. Even in the Urungwe area it is only a question of yielding a limited amount of further ground. The fly advance can, in any case, be arrested in the more favourable country further east.

This state of affairs may be compared with that existing particularly in the years from 1923 to 1930, when the advancing fly was establishing contact with and threatening to dislodge European settlement in the districts of Darwin, Lomagundi, Hartley and Wankie, as well as destroying native cattle over considerable tracts of country.

No further cases of Sleeping Sickness have occurred in any of the areas throughout the year. The cases amongst the hunters in the Gatooma area last year have mostly been traced by the Medical Department to one centre on the Umniati River, outside the area of operations.

Operations.—During the year approximately 19,000 head of game were destroyed in the area covered by these operations, which are confined to a fringe about twenty miles wide surrounding the main “fly” belt.

The whole of the Sebungwe district, excluding two very small areas, one in the extreme south-west corner and the other near the Mafungabusi Peak, together with the whole of the Zambesi Valley in the Lomagundi district and most of the Zambesi Valley in the Darwin district constitute in practice game reserves in which the game is unmolested and in which during the last few years game has been increasing rapidly. The total number of game destroyed annually in connection with these operations must constitute a small proportion only of the annual natural increase of game in the remainder of the “fly” infested areas.



Burning the Eastern Border anti-tsetse clearing, Chipinga sub-district, October, 1934, to destroy re-growth.



Creation of clearing in the Chiredza Valley in 1933. A number of large trees were involved.

1. *Operations, Lomagundi (Doma).*—No cases of trypanosomiasis have been recorded from this area during the year. The proclaimed "fly" area was abolished in June and all restrictions on the movement of traffic were withdrawn. Native cattle are now being introduced into the southern fenced zone. Operations against game were continued during the year with unpaid native hunters, and the fences maintained in repair. The question of the operations being extended northwards to the escarpment is under consideration.

2. *Operations, Lomagundi (South-West).*—The very great improvement in this area recorded in my report for 1933 has been maintained and even increased. Density surveys carried out during the year indicate a further retrogression of "fly" towards and down the Umfuli River, and the whole of the Magondi Reserve may now be considered free from "fly." No cases of trypanosomiasis have been recorded from this area during the year. Operations against game have been continued with unpaid hunters under the control of a European ranger, and the game fences have been kept in repair.

3. *Operations, Urungwe.*—This is a most difficult area to deal with, and despite the intensified cordon of native hunters the major portion of the Urungwe Native Reserve remains infested with "fly." The position is aggravated by the presence of a number of elephant and rhinoceros in the western portion of the reserve which have been protected. Recent density surveys indicate that no definite extension of the "fly" has occurred during the year, though there has been no real improvement. A number of cases of trypanosomiasis of both European and native stock have occurred on the Naodza River, several miles east of any known "fly."

4. *Operations, Gatooma District.*—The operations in this area, which includes a portion of both the Gwelo and Sebungwe districts, have been continued unchanged during the year, except for a reduction in the number of paid native hunters employed from 100 to 80. In view of the continued retrogression of "fly," as indicated by density counts taken throughout the year, it has been possible to withdraw the hunters from the flanking fence area north of the Deweras Estate and to concentrate more on the western unfenced area. Within the fenced area flies are now reduced to a minimum,

only occasional flies being found close to the western fence. Outside the western fence "fly" densities are still high, though some reduction has taken place.

It is disappointing to have to record, particularly in view of the continued retrogression of "fly" westward, that sixteen new cases of trypanosomiasis were recorded from this area. Nine cases occurred on the Government Trypanosomiasis Camp (Woodstock Farm), five on an adjoining farm—both closely associated with traffic on Rob's Drift Road—and two on a section of Rhodesia Plantations. The remaining farms in this area have remained free from the disease and there is every reason to hope that this favourable position will be maintained.

5. *Operations, Darwin.*—No cases of trypanosomiasis have been reported during the year from this area. Only one "fly" has been reported as having been seen south of the escarpment and native-owned stock are being grazed nearer the escarpment than formerly. As long as the Zambesi Valley below the escarpment is infested with "fly" occasional flies will always be brought up on to the high veld by traffic from the Valley, rendering the land close to the escarpment dangerous for stock. Most of the Kandeya Native Reserve and the Crown land west of the Ruia River is now fairly safe for cattle, and an increase in the number of kraals with cattle is expected in the near future.

6. *Operations, Wankie District.*—Although density counts taken throughout the area and the returns from the traffic cleansing stations indicate a slight reduction in "fly" during the year, the position is more or less unchanged. The Gwaai River Valley is still slightly infested with "fly" for some 60 miles of its course above its junction with the Shangani River. Game is still very abundant in the area, particularly on the Shangani River. Owing to a series of seasons with under normal rainfall a heavy influx of game into the area occurred both from the north and from the Wankie Game Reserve. For some reason fewer elephants from the Game Reserve have been drinking in the Sekume River than in previous years. "Fly" has shown a tendency to spread along the Shangani River towards the Shangani Native Reserve, necessitating more intensive operations above the Tshongokwe River.

Most of the Gwaai River Settlement farms are still infested with "fly," and it will be several years before it will be safe to introduce highly susceptible animals, such as oxen, on to these farms. The absence of draught animals has delayed the economical development of these farms, and some of the settlers are in serious financial difficulties. Financial assistance in the form of loans has been granted to some of the settlers for the purchase of oxen, wagons, implements, etc., and for the construction of dams. Permission has been granted during the year for these settlers to shoot in a strictly limited area north of the Shangani River, whereas they were previously restricted to the "open" area between the railway line and the Gwaai River and to the reserve between the Gwaai and Shangani Rivers. Permission has also been granted for them to take motor cars to the Shangani River. This settlement, which was originally intended to act as a barrier between the advancing "fly" and "fly" free country can no longer be considered as being an essential part of the scheme to prevent further encroachment of "fly." There is no sustained hunting on the part of the settlers, who are to-day more concerned with the economic development of their farms.

Operations under the Control of the Native Department.—

(a) *Shangani Reserve*.—The operations in this area have been continued under the supervision of the Assistant Native Commissioner. The position remains stationary except for a slight tendency of the "fly" to spread along the Shangani River. Native cattle on the Shangani River have been removed and no further cases of trypanosomiasis have been reported.

(b) *Sipolilo*.—The great improvement recorded in last year's report has been maintained, and as far as can be ascertained from native reports and from investigations carried out by this office, no flies are now permanently established on the high veld south of the escarpment. Portions of the low-lying valleys of the Hunyani and Dandi Rivers are still lightly infested. The area cleared of "fly" since the year 1924 is estimated at approximately 400 square miles, and arrangements have been made to consolidate and maintain this position, using a skeleton force of selected native hunters who will be paid only their hut tax.

Traffic Control.—Nine cleansing chambers were maintained for the whole year, two were closed down in June and authority has been obtained for the erection of a small chamber for pedestrians in the Urungwe district.

(a) *Tchetchenini Road (Lomagundi, Doma).*—In consequence of the greatly improved position in this area a number of special permits were issued in 1933 which authorised oxen being taken into the area as far north as the deflying chamber. Early in the present year it was decided to remove these restrictions altogether, and in June the proclaimed "fly" area was abolished and the chamber closed down.

Twenty-four (24) cars, four hundred and six (406) cyclists and several hundred pedestrians passed through the chamber up to the end of June. No flies were caught by the guards, compared with one during 1933.

(b) *Miami-Zambesi Road (Miami).*—The number of flies caught at this chamber during the year is in excess of the number caught during the previous year, although the amount of traffic using the road remained fairly constant, there being a slight decrease in the number of cars and an increase in pedestrian and cyclist traffic.

One hundred and thirty (130) cars, one thousand five hundred and seventy-seven (1,577) pedestrians, and seventy-five (75) cyclists passed through the chamber, bringing a total of 178 flies (106 males and 72 females); 75 flies (48 males and 27 females) off cars and 103 (58 males and 45 females) off pedestrians and cyclists. The total numbers of flies caught in 1932 and 1933 were 106 and 94 respectively. These figures are an indication of the somewhat unsatisfactory position in this area.

A second deflying chamber for pedestrian traffic from the north has been authorised and is being erected.

(c) *Copper Queen Road—Lomagundi South-West.*—The improvement in this area was maintained during the year and in June the proclaimed "fly" area was abolished and all restrictions on traffic removed. Up till June when the cleansing chamber was closed down, thirty-six (36) cars, two thousand eight hundred and thirty-five (2,835) pedestrians and one hundred and twenty-five (125) cyclists had passed through the chamber bringing no flies.

(b) *Rob's Drift Road, Gatooma*.—One hundred and ninety-six (196) cars passed through the chamber during the year compared with two hundred and thirty-three (233) in 1933. A total of 478 flies (285 males and 193 females) were caught at the chamber, 239 (143 males and 96 females) off cars and 239 (142 males and 97 females) off pedestrians and cyclists, compared with 498 flies in 1933 and 377 flies in 1932. The vast majority of the flies caught are brought by traffic originating west of the western fence.

(c) *Bulawayo-Victoria Falls Road*.—Five main cleansing chambers and a temporary chamber at the main camp have been maintained in this area during the year.

The number of flies caught shows a progressive decrease over previous years, indicating a slight improvement, although the position is still far from satisfactory. Nine special permits were issued authorising motor cars being taken to the Shangani River. One conviction was obtained for contravention of the regulations.

(i.) *Dett Valley Chamber*.—Owing to the deviation of the main road from Gwaai Bridge to Wankie there was less traffic using the Dett Valley Road than previously. It is still necessary to maintain this chamber to deal with local traffic and traffic to the Wankie Game Reserve.

Two hundred and fifty-eight (258) cars, nine hundred and fifty-one (951) pedestrians, sixty-four (64) cyclists, (401 parties) and one hundred and thirty (130) animals passed through the chamber bringing 59 flies (19 male and 40 females); 38 (10 male and 28 female) off cars and 21 (9 male and 12 female) off cyclists and pedestrians. During 1933, 183 flies were caught and 336 in 1932.

(ii.) *Farm 114 Chamber*.—The number of cars using the Bulawayo-Victoria Falls Road has increased considerably during the year—mostly consisting of tourists visiting the Victoria Falls. In 1933 518 cars passed outwards through the chamber compared with 743 during the present year. Inward pedestrian traffic has also been examined for part of the year, four flies being caught. The following traffic passed through the chamber, seven hundred and forty-three (743) cars, one thousand nine hundred and twenty-seven (1,927) pedestrians,

one hundred and nine (109) cyclists—(923 parties)—bringing 104 flies (53 male and 51 female); 27 (10 male and 17 female) off cars and 77 (43 male and 34 female) off pedestrians and cyclists. In 1933, 152 flies were taken at this chamber and 299 in 1932.

(iii.) *Walker's Road Chamber*.—Four (4) cars, one thousand seven hundred and twenty-six (1,726) pedestrians and twenty-five (25) cyclists—(889 parties)—were treated at the chamber bringing 551 flies (340 male and 211 female); 37 off cars and 514 off pedestrians. The numbers caught in 1933 and 1932 were 989 and 4,180 respectively. Motor traffic on this road was subjected to special permission in 1932.

(iv.) *Sikumi Farm Chamber*.—During the year one hundred and nineteen (119) cars, one thousand five hundred and ten (1,510) pedestrians, nine (9) cyclists—(633 parties)—and fifty-three animals passed through the chamber bringing 30 flies (17 male and 13 female) all off pedestrians. During seven months in 1933, 64 flies were taken at this chamber.

(v.) *Mabare Valley Chamber*.—This chamber is situated on the new deviation from Gwaai Bridge to Wankie and deals with most of the motor traffic to and from the Victoria Falls.

Tsetse flies are known to occur on both sides of this chamber and for this reason pedestrian traffic, both entering and leaving the area, is examined. A new chamber is to be erected on this road at a point where the Copper Mine Road crosses the main road.

The following traffic was examined during the year:—

(a) *Out of the Area*.—Five hundred and thirty-seven (537) cars, two hundred and twenty-seven (227) pedestrians, thirty-nine (39) cyclists—(139 parties)—bringing 146 flies (72 male and 74 female); 75 off cars (34 male and 41 female) and 71 off pedestrians (38 male and 33 female).

(b) *Into the Area*.—Two hundred and two (202) pedestrians, eighteen (18) cyclists—(103 parties)—bringing 50 flies (23 male and 27 female). Total 196 flies (95 male and 101 female) for the year compared with 154 flies (87 male and 67 female) during ten months in 1933.

(vi.) *Darwin*.—Two chambers in this area deal with pedestrian traffic crossing the escarpment from the Zambesi Valley. The following traffic was examined during the year:—

(a) Masongerera's Path.—Twenty-four thousand two hundred and twenty-four (24,224) pedestrians bringing 9 flies (4 male and 5 female), compared with 12 flies in 1933 and 100 in 1932.

(b) Nyamarapara Path.—Two thousand four hundred and twenty-nine (2,429) pedestrians bringing 85 flies (61 male and 24 female) compared with 97 flies in 1933 and 112 flies in 1932.

Operations.—Melsetter.—The results of the border clearing operations appear to be reasonably satisfactory to date. Of the farms protected by the clearing created in 1932, all have remained free from trypanosomiasis except two, and only a few cases have occurred on these. Following the extension of the clearing southwards across the Inyamadzi and Chiredza valleys in 1933, the farms "Lettie Swan," "Confidence" and "Stirling," which suffered very heavily last year, have shown a greatly reduced number of cases, whilst the number of cases has increased on "Gungunyana" still further south. The cattle belonging to "Houtberg" appear to have contracted infection on "Gungunyana." During 1934 the border clearing has been extended southward from the Chiredza valley past "Mount Selinda," to the southernmost beacon of "Jersey." It is hoped that this extension will protect "Gungunyana," "Mount Selinda," and "Jersey," as well as other farms in that vicinity.

The comparatively few cases which occurred behind the barrier clearing might be due either (1) to weaknesses at certain spots in the clearing itself, or (2) to a few flies having been present in Rhodesian territory and been cut off by the clearing. With the former explanation in view, the old clearing has been widened during the year at certain apparently weak spots. If the latter suggestion is correct it appears doubtful if flies so cut off will survive indefinitely.

The return of confidence due to the apparent effect of the earlier constructed portion of the clearing has led to cattle

being moved back in numbers to certain farms previously evacuated, and there is talk of re-occupation of other farms, which have been lying unused.

Conservation of the clearing has entailed considerable labour. Fierce grass fires have been used as much as possible to destroy coppice and root suckers. The burning was carried out in October and had a very good effect where the grass was long, namely on ground previously dominated by Bloodwood (*Pterocarpus angolensis*) and Corkwood (*Parinarium curatellae-folium*). In certain patches of streambank and close forest, and particular of "Mujanji" (*Uapaca kirkiana*) much slashing back of root growth has been necessary owing to the scarcity and poor growth of grass. It is judged that repeated slashing will lessen the vigour of the roots and that grass will gradually invade the deforested patches, tending to easier and less expensive control in the future.

Experiments with poisoning of trees during the year indicate that this method might in future be utilised to advantage especially against such trees as *Uapaca* and *Brachystegia*.

Poisoning of Native Trees.—One of the great difficulties with production of permanent clearings against tsetse fly or for other purposes, lies in the vitality of many native trees and their tendency to production of coppice and root suckers. Coppicing can be prevented by piling the cut branches over the stumps and burning them, but this procedure does not prevent the growth of suckers from the roots, and probably encourages it.

Consequently, the discovery of methods of killing the trees completely, including the roots, is of great practical importance. Reports published by the Department of Tsetse Research in Tanganyika Territory, have indicated that trees could be destroyed entirely by use of arsenic pentoxide and sodium arsenite properly applied, and it was decided, therefore, to carry out similar tests against native trees in Southern Rhodesia. This was done in collaboration with the Division of Forestry, certain species being treated under the direction of the Chief Forest Officer whilst others were treated by the Division of Entomology.

One point which was not apparent from the Tanganyika report was, whether the poison would act equally well if the

tree were previously felled and the stump treated. This was regarded as of importance in view of the necessity in some cases of obtaining a complete clearing as quickly as possible without having to wait for the timber to fall.

The series of experiments included all the dominant trees of the natural forest with parallel tests of applying poison by (1) the "frilling" method with the trees left standing, and (2) felling the trees and treating the stumps. The results of these experiments to date appear to be promising, but it is too early to draw any definite conclusion in reference to the final effect on the root systems.

Screw-Worm.—The position regarding myiasis in ranch cattle, due to infestation of wounds by the maggot of the screw-worm fly, *Chrysomia bezziana*, Vill., continues to be serious. It has not been possible to carry out field investigations during the year.

One case of myiasis in sheep due to screw-worm late in the rainy season was reported from Melsetter.

Tick Survey.—The collection and identification of ticks from the Colony was continued. One scarce species, *Rhipicephor nuttalli*, C. & R., was found on a dog at Rusape.

ADMINISTRATIVE AND GENERAL.

Tobacco Pest Suppression Act, 1933.—This Act has now completed its first full year in operation. The whole-time Inspector appointed under the Act in August, 1933, inspected each premises at least once during the year. Although a few premises were inspected more than once, it was found, as anticipated, impossible to inspect all farm premises more than once. The provisions of the Act are generally welcomed by the growers, and very few petty evasions have been evident under Part 1, which deals with pests of cured tobacco. A small outbreak of the Stored Tobacco Worm (*Ephestia elutella*, Hubn.), in a country warehouse and minor infestations of the Tobacco Beetle (*Lasioderma serricorne*, F.) are referred to earlier in this report. Under Part 2 of the Act, dealing with declared pests of growing tobacco, several prosecutions have been necessary, and in most cases welcomed by neighbours of the offenders. They were largely the result of

carelessness, lack of interest, or ignorance of the law. Abandonment of tobacco as a crop, or abandonment of farms were the chief primary causes. In general, however, growers appreciate the benefit of the simple measures enforced and now apply them with greater assurance that their neighbours are doing likewise.

Licences were granted in respect of six hundred and forty-nine (649) premises for the year ended 31st December, 1934. Applications were received for five hundred and twelve (512) licences in respect of the year 1935 and the necessary licences prepared for distribution. It is gratifying that the number of licences still outstanding is very considerably smaller than at the end of 1933. Six hundred and eighty-three (683) inspections of warehouses and farm premises were made during the year.

Importation of Plants Regulation Ordinance, 1904.—The following consignments have been dealt with by the Plant Inspectors at the various ports of entry during the year:—

Salisbury	2,741
Bulawayo	9,331
Umtali	644
Gwelo	833
Plumtree	673
	<hr/>
	14,222
	<hr/>

One hundred and forty-three (143) Special Permits for the introduction of plants, etc., into the Colony were issued.

Sixty-six (66) Annual Permits were granted to registered nurserymen in the Union of South Africa.

Regulations in Other Countries affecting Export of Plants from Southern Rhodesia.—Eighty-one (81) certificates of cleanliness were issued in respect of plants, etc., intended for export to other countries. The figure for last year was one hundred and twenty (120), the decrease being due largely to the fact that certificates of cleanliness in respect to the Stored Tobacco Worm (*Ephestia elutella*, Hubn.) in tobacco exported to the Union of South Africa have no longer been required.

Injurious Substances and Animals Ordinance, 1909.—Three (3) certificates for the importation of beeswax and foundation comb from overseas were issued during the year.

Nurseries Ordinance, 1909.—Nineteen (19) nurseries were registered during the year and nineteen (19) inspections made. One nursery was placed in quarantine on account of Red Scale, *Chrysomphalus aurantii*, Mask.

Farms Visited.—One hundred and twenty-seven (127) farms were visited and advice given on insect pest control, besides the six hundred and eighty-three (683) inspections made under the Tobacco Pest Suppression Act, 1933.

Lectures.—Three lectures to the B.S.A. Police on ticks and one lecture to farmers were given by members of the staff.

Conferences.—The Chief Entomologist attended the Inter-State Locust Conference at Pretoria July 30th to August 3rd as delegate from Southern Rhodesia.

Entomologist M. C. Mossop attended the International Locust Conference in London September 11th to 18th, being included in the British Delegation.

Papers Published.

1. "Screw-worm: A Pest of Ranch Cattle in Southern Rhodesia," by A. Cuthbertson. *Rhodesia Agricultural Journal*, XXXI., Salisbury, 1934, pp. 100-111.
2. "The Tobacco Pest Suppression Act, 1933: An Outstanding Instance of the Result of the Neglect of Tobacco Lands," by R. W. Jack, *Ibid.* pp. 177-179.
3. "Locusts: Instruction for dealing with Flying Swarms," by the Division of Entomology. *Ibid.* pp. 180-184. (A slightly modified reprint of Bulletin No. 890.)
4. "The Life History of the Screw-worm Fly," by A. Cuthbertson. *Ibid.* pp. 256-258 (Illustrated).
5. "Tsetse Fly and Game," by R. W. Jack. *Ibid.* pp. 259-294 (with map).
6. "Myiasis (Screw-worm) in Cattle in Southern Rhodesia," by D. A. Lawrence and A. Cuthbertson. *Ibid.* pp. 348-355 (Illustrated).

7. "Biological Notes on some Diptera in Southern Rhodesia," by A. Cuthbertson. *Proceedings and Transactions Rhodesia Scientific Association*, XXXIII., Salisbury, 1934, pp. 32-50.
8. "Notes and Observations on some Experiments in dusting Locusts from the Air," by J. K. Chorley. *Proceedings Third International Locust Conference*, The Secretariat General, London, November, 1934. Annex to App. 8.
9. "Locusts in Southern Rhodesia," by R. W. Jack. *Ibid.* App. 20.
10. "The Destruction and Control of Locust Hoppers," by R. W. Jack. *Rhodesia Agricultural Journal* XXXI. Salisbury, 1934, pp. 856-864 (Illustrated).
11. "Locust Poison. Directions for Use—1934-35 Campaign," by R. W. Jack. *Ibid.* pp. 887-889.
12. "Note on the Swarming of Pentatomid Bugs," by A. Cuthbertson. *Nada*, XII., Salisbury, 1934, p. 38.
13. "Monthly Reports on the Locust Position," by R. W. Jack. *Rhodesia Agricultural Journal* XXXI., Salisbury, 1934.
14. "Systematic and Biological Notes on some Asilidæ (Diptera) of Southern Rhodesia, with a Description of a Species new to Science," by E. O. Engel and A. Cuthbertson. *Proceedings and Transactions Rhodesia Scientific Association* XXXIV. Pt. pp. 35-47 (Illustrated).

The Insect Collection.—The following numbers of insect species were identified by the museum and institutions named:—The British Museum (Natural History) and the Imperial Institute of Entomology, London, 86; The American Museum of Natural History, New York, 70; Dr. Hall, Director of the B.S.A. Company's Citrus Experiment Station at Mazoe, 40; The Rhodesian Museum, Bulawayo, 15. During the year over 300 species of insects were sent overseas for identification.

A small collection of about 90 species of Diptera, including the types of some species new to science, was presented by the Division to the Rhodesian Museum at Bulawayo. In addition, insects have been sent by request to the following museums and universities:—The South African Museum, Cape Town; The Durban Museum; The Natal Museum, Pietermaritzburg; The South Australian Museum, Perth; The British Museum (Natural History); The Zoological Institute, Tharandt, Germany; The State College of Massachusetts, Amherst; The United States Department of Agriculture, Washington, D.C.; The University of Glasgow; Harvard University; The University of Liverpool.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 31, June, 1935.

The locust position throughout June has remained quiet, but swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) have been recorded from the following districts, namely, Bubi, Chibi, Umtali, Gutu, Mrewa, Lomagundi and Chilimanzi. The majority of these swarms have been described as "large."

A noteworthy occurrence was the receipt of fifth stage hoppers of this species collected in the Shangani Reserve, Bubi District, on the 4th of the month, constituting by far the latest seasonal occurrence of hoppers of this species recorded in the Colony during the present cycle.

No definite direction of flight is apparent from the records. At this time of year, the swarms generally are comparatively inactive.

No disease has been recorded or reported amongst the locusts.

No damage has been recorded.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

MAY, 1935.

AFRICAN COAST FEVER.

Charter District.—A case of the disease was diagnosed in an animal slaughtered on the Worcestershire Estate. The herd was removed to fresh grazing.

No mortality occurred at any of the previously infected centres.

FOOT AND MOUTH DISEASE.

Only two extensions of disease occurred, one farm in Salisbury and one farm in Selukwe district.

TRYPANOSOMIASIS.

Three cases occurred in Melsetter, three in Bubi and one in Wankie district.

HORSE-SICKNESS.

One case in the Salisbury, three in Melsetter and six in Umtali district.

TUBERCULIN TEST.

Sixty-six animals were tested on importation with negative results.

MALLEIN TEST.

Sixty horses were tested upon entry; no reactions.

IMPORTATIONS.

From the Union of South Africa:—Bulls 7, cows 52, calves 6, horses 57, sheep 60.

Bechuanaland Protectorate:—Sheep 1,034, goats 191, pigs 30.

United Kingdom:—Bulls 2, horses 2.

EXPORTATIONS.

To Northern Rhodesia:—Horses 11, sheep 252.

EXPORTATIONS.—MISCELLANEOUS.

To the United Kingdom *via* Union Ports in Cold Storage.
—Chilled beef quarters, 11,045; frozen beef quarters, 114; frozen boned beef quarters, 8,167; frozen boned veal quarters, 92; tongues, 10,023 lbs.; livers, 32,403 lbs.; hearts, 12,769 lbs.; tails, 7,018 lbs.; skirts, 3,802 lbs.; shanks, 25,848 lbs.; kidneys, 2,862 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 21,382 lbs.; meat meal, 89,600 lbs.; beef powder, 61,032 lbs.; horns, 14,504 lbs.; beef fat, 46,600 lbs.; tongues, 5,400 lbs.; corned beef, 21,600 lbs.

From Rhodesian Export & Cold Storage Company: Beef fat, 47,398 lbs.; horns, 20,251 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JUNE, 1935.

Pressure.—Mean pressures were about normal over the South of the country, and slightly below over the North.

Temperature.—The month was notably cold, mean temperatures varying from 2 to 4 degrees below normal.

Rainfall.—Rain was reported from a large number of stations during the first few days of the month.

Hail.—Hail was reported from about 27 stations on the 1st May. The worst fall appears to have been at Home Farm, in the Selukwe district. The observer remarks: "Very heavy thunder and vivid lightning at 12.30 p.m. on the 1st. Heavy hail did a lot of damage and ruined gardens. In places hail was 18 inches deep, and at 3 p.m. on the 2nd 6 inches still remained. The hail killed a large number of young game birds, chiefly guinea fowl."

JUNE 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point F.	Cloud Amt.	Precipitation.		Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.						Ins.	Nor- mal				No. of Days		
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.								
Angus Ranch...	...	...	78	41	71.2	46.8	59.0	61.6	54.9	50.4	73	47	..	0.04	0.12	1	...
Belt Bridge...	971.1	...	82	38	75.3	44.5	59.9	...	56.9	49.8	60	43	0.8	0.34	0.00	2	1,500	
Bindura...	895.9	...	76	39	70.3	45.2	57.8	...	55.0	49.7	69	45	2.1	0.59	0.02	3	3,700	
Bulawayo...	873.1	...	72	32	66.3	41.6	53.6	...	54.1	46.0	54	37	2.8	0.01	0.03	1	4,426	
Chipinga...	896.6	...	72	42	64.7	47.9	56.3	...	56.8	51.6	73	47	3.7	0.42	0.41	8	3,685	
Enkeldoorn...	861.5	...	72	35	65.6	42.3	54.0	...	57.4	52.9	66	41	2.3	0.00	0.03	...	4,788	
Fort Victoria...	901.0	...	74	33	67.1	40.0	53.5	...	54.4	48.3	65	43	3.5	...	0.07	...	3,571	
Gwaai Siding...	909.3	...	79	30	74.3	36.4	55.3	...	49.5	43.3	59	37	0.9	0.00	0.00	...	3,278	
Gwanda...	911.6	...	77	32	69.2	41.3	55.3	...	50.9	44.7	61	38	2.1	0.02	0.06	1	3,229	
Gwelo...	866.6	...	72	34	66.0	41.1	53.6	...	57.1	45.8	62	39	2.1	0.00	0.02	...	4,622	
Hartley...	889.5	...	76	32	70.9	40.1	55.5	...	53.0	47.5	65	43	1.3	0.04	0.00	1	3,879	
Inyanga...	839.8	...	68	32	63.9	39.2	51.6	...	52.9	46.1	60	39	2.2	1.20	0.05	3	5,514	
Marandellas...	840.8	...	68	37	62.4	42.4	52.4	...	51.1	46.1	73	42	3.0	0.53	0.06	3	5,453	
Miami...	882.9	...	76	40	69.8	44.7	57.3	...	57.6	50.6	62	45	2.4	0.04	0.02	3	4,090	
Mount Darwin...	911.9	...	77	35	72.6	43.0	57.8	...	59.1	53.1	67	48	3.2	0.23	0.03	3	3,179	
Mount Nuza...	804.0	...	62	35	53.3	40.3	46.8	...	45.3	42.2	79	39	4.0	2.08	...	4	6,668	
Mtoko...	813.5	...	74	43	69.3	47.2	58.5	...	57.1	51.7	70	47	2.1	1.22	0.00	3	4,141	
New Year's Gift...	...	...	79	43	71.4	47.8	59.6	...	55.9	51.1	71	47	...	0.18	0.23	4	2,690
Nuanetsi...	968.9	...	82	34	74.5	41.3	59.4	...	58.2	51.5	63	46	2.6	0.00	0.05	...	1,581	
Plumtree...	868.7	...	74	37	65.9	44.2	55.1	...	54.6	45.6	49	36	1.1	0.00	0.00	...	4,549	
Que Que...	886.2	...	75	35	69.8	41.2	55.5	...	54.2	46.9	58	39	0.7	0.00	0.00	...	3,999	
Rusape...	866.2	...	73	35	64.8	41.1	53.0	...	50.8	48.0	83	46	3.3	0.55	0.11	2	4,648	
Salisbury...	858.2	858.8	73	36	67.3	41.2	54.3	...	54.8	48.4	63	43	2.3	0.45	0.05	3	4,885	
Shabani...	913.1	...	77	41	68.7	46.2	57.5	...	53.0	47.5	66	42	3.4	0.10	0.11	1	3,193	
Sinoia...	892.5	...	76	34	72.1	39.1	55.6	...	54.5	48.7	64	43	1.0	0.06	0.02	2	3,795	
Sipitilo...	889.2	...	74	38	69.9	44.6	57.3	...	57.9	50.3	56	44	2.4	0.49	0.02	4	5,304	
Stapleford...	845.4	...	67	29	59.4	35.4	47.4	...	48.3	46.5	87	45	3.0	2.11	0.64	4	3,672	
Umtali...	897.7	897.9	76	40	69.1	45.7	57.4	...	55.8	51.8	77	48	3.9	0.56	0.21	3	2,990	
Victoria Falls...	...	...	82	35	76.8	46.9	61.9	...	53.3	46.5	60	39	0.6	0.00	0.01	...	2,567
Wankia...	932.7	...	82	39	76.7	49.4	63.0	...	55.7	47.2	52	39	0.4	0.00	0.00	...	...

Farming Calendar.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and,

if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farm-yard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, $1\frac{1}{2}$ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of $\frac{1}{2}$ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphids previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tube-rose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vleis lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphid and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphid previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

FOR SALE.

Order your TOBACCO CURING RECORD BOOKS from The Art Printing Works NOW, 5/6 each, post free. Sample Sheet on request.—Phone 2428 or write Box 431, Salisbury.

FOR SALE.—Somerset Sunn Hemp, 17/6 bag; 10 bags at 17/-; broadcasts 10 acres a bag; f.o.r. Tafuna; c.w.o.—C. M. Townshend, Shamva.

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MISCELLANEOUS.

TENDERS are invited for the supply of young ewes, free of any complaint, for breeding purposes, f.o.r. Marandellas.—Write A. M. Close, Box 604, Bulawayo.

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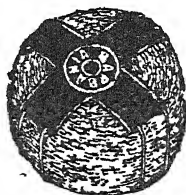
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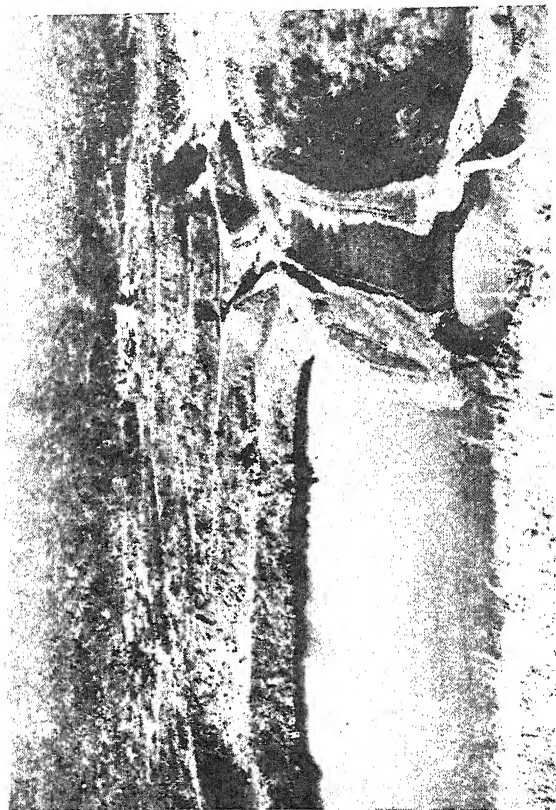


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Earthen Dam constructed by Capt. J. M. Moubray on his farm Chipoli.

THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

SEPTEMBER, 1935.

[No. 9.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Earthen Storage Dam at Chipoli.—The illustration shows a large earthen storage dam at Chipoli which is now nearing completion. It is situated on a tributary of the Mazoe River which has practically no winter flow and the dam therefore has been constructed for the storage of flood water, the catchment area discharging into it being 20 square miles in extent.

Some years ago Capt. Moubray constructed a low masonry weir at this point and later utilised it as a core-wall for the earthen embankment. He has kept a small gang of natives steadily employed on heightening the embankment ever since and a maximum depth of 46 feet of water is capable of being stored there now, the storage capacity being 400 million gallons.

This storage would suffice for the irrigation of 500 acres if the dam filled each year, but as the catchment area is limited this cannot be relied on and the dam has never completely filled, although last season the water was within three feet of the spillway level. The dam is an indispensable adjunct for the irrigation of some 160 acres of citrus and other crops on Chipoli, and Capt. Moubray is satisfied that the money spent on its construction has been justified by the results.

Poultry Keepers Please Note.—The attention of all poultry keepers is drawn to the draft Egg Control Bill and memorandum dealing with it published in this number. It must be clearly understood that the publication of this draft does not imply that any legislation has been passed in this form, nor necessarily that any such action will be taken, but it is the wish of the Government that the desirability of such action should receive the careful consideration of all persons interested in egg production and marketing in the Colony. The draft and memorandum will be reprinted and copies can be obtained, free of cost, on application to this office.

Tobacco Research, 1935-36.—At a meeting of the Tobacco Research Board held early last month the programmes of research for next season were approved. All the work on the flue-cured tobacco will be concentrated on the Trelawney Station under the direction of Dr. J. C. Hopkins, Senior Plant Pathologist. The fire cured tobacco experiments will be carried out by Mr. C. E. Strickland, on his farm Lion's Den, Shamva, under the supervision of the special committee of the Rhodesian Fire Cured Tobacco Association, of which Capt. J. M. Moubray is chairman.

New Crops Tested Out.—In August, 1932, a list was published in this Journal of the various crops tested out on the Salisbury Experiment Station during the previous twenty-one years. This was reprinted as Bulletin 859 and is still available. Enquiries have been received recently regarding plants

grown for the production of essential oils, drugs, insecticides, etc., and since a number of these have been tried in the last few years notes will be published from time to time concerning the results obtained.

Psyllium Seeds.—It is evident that the use of *Psyllium* Seeds (*Plantago psyllium* L., the “Fleawort” or “Fleaseed”) for medicinal purposes, is becoming more widespread. The seeds have always been a fairly common commodity in certain Continental countries, such as France and Spain, where they are held in high repute as a laxative and are one of the well-known domestic medicines, but outside Europe and the Near East they have been comparatively little known and used. At the present time, however, there is a brisk demand for the seeds in the United States, and signs are not wanting that increased interest is being taken in the seeds as a therapeutic agent in this country. It was recently reported that the demand in the United States was in excess of supply and that imports from South Europe had increased to a surprising degree.

It is to the peculiar property of secreting a large quantity of mucilage on being placed in water that the seeds owe their medicinal value. The presence of the mucilage renders the seeds demulcent and emolient and they are used in cases of catarrh, dysentery and other inflammatory disorders. Other seeds secreting mucilage in a similar manner and employed in internal medicine are Flax, Sesamum and Ispaghul Seed (*Plantago ovata* Forsk). Apart from medicinal uses *Psyllium* Seeds are employed to some extent in Europe in the preparation of dressings for textiles, particularly for silk fabrics, muslin and lace. The dressings are prepared by boiling the seeds for some time with the requisite quantity of water. The mucilage from the seeds has also been used for toilet purposes.

The production of the mucilage, which is perfectly clear and of a jelly-like consistency when formed in the presence of a limited quantity of water, is due to the action of water or aqueous fluids on the superficial cells of the seeds. It is located principally in the surface layers of the seed coat, the seeds containing up to 15 per cent. of mucilage. In contact with water the surface-cells first swell considerably, and finally

burst, forming a mucilaginous mass. When administered internally the seeds reach the intestines in a condition exactly suitable for emulsification and are claimed to fulfil a dual role. The liberation of the mucilage of the seeds and emulsification of their oils produces a mode of action distinctly laxative, while the mechanical action of the seeds themselves is to facilitate the division of the food-mass and to excite secretion of the gastric juice without in any way impoverishing its digestive power.

Plantago psyllium is native to the Mediterranean region and extends eastwards into Persia. It appears to favour dry sandy soils, and is often of a semi-trailing habit. The small globose inflorescences, each of which produces about a dozen of the brown boat-shaped seeds, are borne in the axils of the leaves. The whole plant is somewhat sticky owing to its entire surface being covered with minute glandular hairs. In common with other members of the genus this species grows freely and can be cultivated with a minimum of trouble provided suitable localities are chosen. It grows so readily in its native habitat that it is frequently to be seen as a weed growing up through the ballast of railway tracks. In cultivation a dry sandy soil is generally chosen. After it has been well worked, in some cases, harrowed and rolled, small furrows are made at distances of about 2 feet. Along these furrows the seed is sprinkled and lightly covered. During the growth of the crop it is usually sufficient for weeding and cultivating operations to be performed once or twice only. The period of harvesting varies according to locality. The whole plant is harvested and after drying the liberation of the seeds is assisted by threshing.

In Rhodesia seed was sown on the Salisbury Experiment Station in December, 1934, but did not do well. On granite sand a short distance from Salisbury it has, however, done extremely well.

Fourth Empire Forestry Conference.—The Chief Forest Officer, Mr. E. J. Kelly Edwards, is at present absent from the Colony as Southern Rhodesian delegate to the Empire Forestry Conference which is being held in the Union of South Africa during September and part of October.

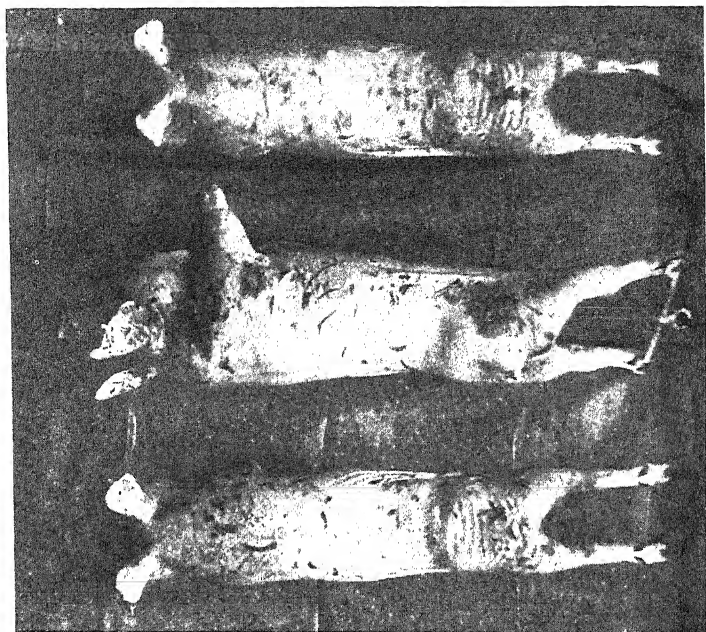


Fig. II

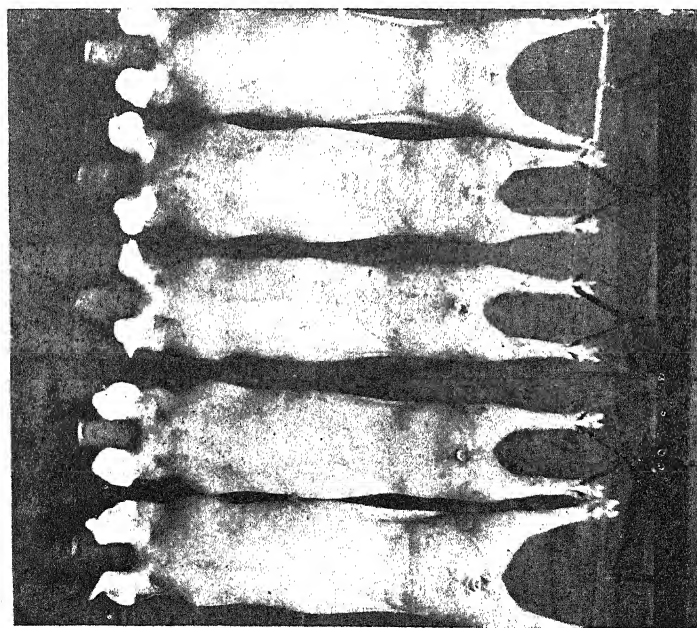


Fig. I

More than fifty delegates will be attending the Conference from almost every Dominion, Colony or Possession of the British Empire where scientific forestry is practised.

The Conference is the fourth of its kind and is held normally every five years in a different Dominion.

Papers from leading Empire authorities will be delivered on various aspects of forestry, and opportunities will occur to visit the main scenes of forestry activity in the Union and for the discussion of forestry problems, both local and of Empire application. Prominence will be given to such questions as the consumption, supply and marketing of Empire timber, and other forest products, soil erosion and water conservation.

All these matters vitally affect not only the Union of South Africa but also Southern Rhodesia, so that the experience gained by this Colony's delegate will be of the greatest value.

Export of Frozen Porkers.—A third consignment of frozen porkers has now been organised and it is proposed to export the pigs early in December.

The bulk of the porkers have been collected in Matabeleland, and a special feature of this consignment is that 60 weaners are being fed out at the Rhodes Matopo Estate as a check lot on the general consignment. These pigs are receiving different rations varied to bring out any difference in the quality of the flesh produced by typical rations used in the Colony.

It is intended to obtain fuller reports on this consignment than on either of the previous two, and an attempt will be made to get reports on flavour and quality from the persons who actually eat the pork.

It is hoped as the result of these tests to lay down a definite policy for export in the coming year.

Typical porkers in the second consignment are illustrated (Fig. 1). Serious bruises were experienced in one or two lots from farmers, and a specially bad case, in which the pigs had to be rejected, is shown in Fig. 2.

Producers have been warned to be most careful in the handling of the pigs. All the porkers have also to receive a proper ration of meat or blood meal, where separated milk is not available, to ensure as rapid a rate of maturity as possible and the proper development of lean meat.

Department of Agriculture and Lands.

IMPROVED U.4/64 COTTON SEED.

Seed of the newer, U.4/64 strains, mainly improvements on U.4/64/7/10 (Gatooma 5-11), are available for sale to growers, in 50 lb. lots, at a charge of 5/- per lot.

The seed has been grown during the past season on the Government Cotton Breeding Station, Gatooma, and is approximately 70% sound.

Applications for cotton seed must be accompanied by a Postal Order or cheque for 5/- made payable to the Accountant, Division of Agriculture and Lands, Salisbury. Exchange must be added if cheques are not drawn on Salisbury.

Applications for seed should be addressed to the Plant Breeder in Charge, Cotton Breeding Station, Gatooma, as early as possible. They will be dealt with in the order in which they are received.

For bulk quantities of U.4/64 strains, grown from earlier Gatooma issues, application should be made to the Bindura Ginnery, Bindura.

H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

23rd August, 1935.

(Sept.-Nov.)

The Use of Ditchers for Constructing Contour Ridges.

By C. TAPSON, Devondale, Concession.

If you have no time to make contour ridges, at least avoid ploughing and cultivating up and down slopes and plant along the contour instead.

I have found that the use of a ditcher materially speeds up the work of constructing contour ridges, and with a good team of 18 oxen 1,000 yards of ridging with a base width of 12 feet and 18 inches in height should be finished comfortably in a day. I prefer to make my ridges with a fall of only 4 feet between them; this leads to closer spacing of the ridges and reduces the area to be drained, provided the length of ridge is not more than 500 yards.

Under these conditions I think 18 inches is sufficient height for a ridge, but if you want to be on the safe side, which is of course always advisable, and make them the normal 2 feet in height, you ought still to be able to construct 800 yards in a day.

My experience has mainly been in the Concession area, and the following remarks as to the best methods of operating a ditcher therefore apply to conditions there.

I find, however, when conducting demonstrations elsewhere, that modifications are necessary to deal with the varying soil conditions, although the general basis of the operations remains the same.

After the ridge has been staked out put in a second line of sticks on the lower side about 6 feet from the original line.

Start ploughing with a 3-furrow disc plough along the second line of sticks, throwing the soil down the slope for preference, and on the return leave about 12 inches of unploughed soil between the two furrows, thus leaving a solid wedge in the middle of the base of the ridge.

For the first ploughing the front disc should be set for a very shallow cut, and with the third disc making a cut about 5 inches in depth.

For the second round the plough should be set with the land lever right up so that a 26 inch disc will leave a furrow up to about 18 inches in depth.

If a Ransome plough is used with the furrow lever right out or back and with the transport or near lever at full depth the effect will be to cause the unbroken pan at the bottom to slope upwards towards the centre of the ridge.

After the second ploughing the ditcher set for a sweep of about 6 feet should be pulled along the furrow with the edge of the land slide pressing against the furrow bank—and the oxen walking along the centre of the ploughed ground.

For this first round two natives sitting on the land slide of the ditcher should suffice to keep it in position without the grader arm operating to any extent, as hauling the ditcher through the ploughed soil alone is usually a sufficient load for 18 oxen whilst they are walking on rough lumpy ground.

The first round should result in a ridge sloping up to a sharp apex about one foot above ground level and leaves a clean path for the oxen to follow in the subsequent rounds. The ditcher is then taken round a second time in the reverse direction with an extra native sitting on the extremity of the grader arm.

This second round should result in a definite sharp peaked ridge about 18 inches in height with a wide furrow on either side with the bottom sloping upwards towards the centre of the ridge.

Another round of the plough then follows with the plough set as before but with only the outside, or at most, two discs cutting new ground, as the draught with more than one disc cutting is too heavy for ordinary oxen whilst walking in the furrow or on the ridge and helping to consolidate it.

The ditcher with the grader arm closed by about one foot follows the plough and deposits the loosened ground along the side of the apex of the ridge and broadens the crest to about one foot in width after two rounds.

To obtain a higher ridge with a broader base proceed with the plough and ditcher as in the immediately preceding round, except that the sweep of the ditcher may be widened if necessary by opening out the grader arm.

These operations can be proceeded with indefinitely and would result in a broad crested ridge with flat slopes and a wide base, and to heighten the ridge it is necessary to cut a furrow with a single furrow mouldboard plough along the side of the ridge to form a resistance for the land slide of the ditcher, which would then be put in there and used for throwing soil on to the crest of the ridge.

The ditcher can be operated successfully over narrow, shallow sluits, and when crossing them the man on the grader arm gets off and lifts the arm to cause the ground to be deposited in the depression. In this way these sluits can be filled in automatically as the work proceeds.

When turning the ditcher is tilted up on to its land slide and held upright by a boy until it reaches the part to be worked. It is simply turned right over if it is required to return along the same furrow.

More defined and deep sluits have naturally to be filled in with dam scrapers or by hand, and the base of the ridge must be widened by about 4 feet for every foot depth of sluit. These dongas, however, can be partially filled up by running a plough along their sides and throwing the ground inwards and, in fact, dongas up to 5 feet in depth with perpendicular sides have been filled in sufficiently this way to enable ploughs and oxen to work across comfortably.

Once the ridge is constructed the dongas will rapidly silt up and be completely obliterated in a few years.

I have found that wide and deep dongas can be conveniently used as temporary ensilage pits, and as these serve as excellent obstructions, causing the deposition of silt in the donga, they effect a dual purpose.

The cost of digging an ordinary pit silo 20 to 30 feet long by 16 feet in width and 10 feet in depth is quite considerable. By selecting a suitable sized donga with fairly perpendicular sides six boys working for 2 to 3 days will

usually suffice to complete the job of straightening the donga to convert it into a silo pit. The ground excavated from the sides in the process of straightening is thrown into the middle of the donga just outside the length of pit required, and usually suffices for the solid ends of the silo. A pole is then laid across the top at each end of the section and let into the banks for about a foot to fix it and a shallow trench 6 inches in lepth is dug across the bottom of the pit immediately under these cross poles. Upright poles are placed in these trenches and tied to the cross poles, grass is laid against these uprights and ground thrown against it. The pit can then be filled and the top covered with soil in the ordinary way.

These pits are, of course, only suitable for use as silos for one season, but will be found to be ideal silt traps and cause silting of the donga for a considerable distance upstream after the first rainy season.

Another useful way of causing dongas to silt is to plant a pole firmly on either side of the slit with three or four strands of wire stretched between them to a height of 2 to 3 feet above the bottom of the donga and laced with thin poles and grass. The donga will silt up to the height of the barrier in one rainy season and the barrier can be heightened by similar amounts in subsequent seasons.

It is not advisable to attempt to silt up a donga for its full depth in one season as the flood water would merely cut round the sides of the barrier and make a new donga.

Salisbury Agricultural Experiment Station

ANNUAL REPORT, 1933-34.

By H. C. ARNOLD, Manager.

During the season under review the total rainfall recorded at this Station was 31.54 inches. This amount is $2\frac{1}{2}$ inches more than the average annual precipitation during the previous ten years. The season proved a favourable one for nearly all crops, though unusually copious rains during the month of November interfered with sowing operations, and the lack of rain during March prevented some of the late sown crops from reaching normal maturity.

Analysis of Rainfall, Season 1933-34.

Month.	No. of rain days.	Total for month in inches.	No. of rains over $\frac{1}{4}$ inch.	Total to end of month.	Periods exceeding one week without rain.
October... ..	3	.46	1	.46	Oct. 5th to Nov. 4th
November	16	9.90	10	10.36	—
December	12	5.20	5	15.56	Dec. 27th to Jan. 3rd
January	19	7.54	9	23.10	—
February	12	6.11	4	29.21	Feb. 15th to 25th
March	8	1.39	2	30.60	Mar. 13th to 21st and 23rd to 29th.
April	7	.94	1	31.54	
	77	31.54	32		5 periods exceeding one week without rain

The rainfall of 9.90 inches is the heaviest recorded for November for many years, and it is nearly four times as much as the average amount recorded for that month during the previous 10 years. On February 14th the seasonal total had reached 28.91 inches and from that date only two showers exceeding .5 of an inch were received. In spite of the fact

of the effective rainfall being concentrated between November 5th and February 14th, which is a period of less than three and a half months, the early sown maize and other crops made satisfactory growth and produced crops which were above the average. The yield of late sown crops were considerably reduced through premature ripening as a result of the absence of rain.

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is drawn up on similar lines to previous ones.

In order that ground space might be released for new experiments, or because they had served their purpose, the following experiments were discontinued.

Exp. No. 6.—Comparison of the effect on maize yields of ploughing land twice instead of once only.

Exp. No. 16.—Comparison of the effect on the yields of maize of applying raw rock phosphate to the preceding green manure crop with that of applying superphosphate to the maize crop following an unfertilised green manure crop.

Exp. No. 18.—Comparison of the effect on the maize crop of applications of (a) raw rock phosphate, (b) superphosphate, (c) a mixture of equal parts of rock phosphate and superphosphate.

Exp. No. 29.—Effect of manurial dressings on the production of sunn hemp seed.

The latter experiment was discontinued because it is thought that the introduction of the "Somerset" variety of sunn hemp will, to a large extent, solve the problem of the economical production of sunn hemp seed.

New experiments commenced during the season under review were as follows:—

Exp. No. 31.—To investigate the comparative effect of various crops, including green manure, on the ground nut crop which follows.

Exp. No. 32.—To investigate the effect of chemical fertilisers on the yield of tops and tubers of the sweet potato crop.

Exp. No. 33.—Investigation into the effect of the date-of-planting on the seed production of "Somerset" sunn hemp.

The hybridisation of Otoxi Soya Beans with a variety whose seed does not readily shatter was undertaken with a view to obtaining strains which will yield heavy crops of fodder and retain their seed for a few weeks after the leaves have fallen. Such strains would enable the grower to harvest his seed crop without the inconvenience and loss often experienced with the types which we have at present.

CROP ROTATION EXPERIMENTS.

FIRST SERIES 1913-34.

Maize Yields in Bags per Acre.

System of Cropping.	1933-34. Rainfall 31.54 in.	1932-33. Rainfall 27.64 in.	1931-32. Rainfall 26.62 in.	1930-31. Rainfall 31.47 in.	1929-30. Rainfall 23.46 in.	1928-29. Rainfall 31.62 in.	1927-28. Rainfall 26.63 in.	Average yields
*A1 —Maize continuous. Green manure and 250 lbs. per acre of phosphatic fertiliser in the seasons 1928-29 and 1932-33...	19.04	Green manure ploughed under	9.60	12.60	15.88	Green manure ploughed under	1.90	9.52 (6 years)
*A2 —Maize continuous. Fertiliser only, rates as above ...	8.74	3.53	10.92	2.99	11.44	6.20	1.90	7.30 (6 years)
†B —Alternate maize and beans for hay; no manure or fertiliser ...	6.60	2.34	10.02	1.95	6.43	5.65	8.15	9.46
C —Three-course rotation: maize, velvet beans (reaped), oats; no manure or fertiliser	10.75	4.90	11.1	11.70	11.36	12.00	12.15	13.90
D —Four-course rotation:— Maize (plus 6 tons dung per acre), oats, bean hay, maize. Average of two plots ...	14.70	14.21	16.33	14.93	15.79	19.00	17.45	
Maize (no manure direct) ...	11.90	14.40	14.80	14.95	13.25	21.35	14.10	17.54 (18 years)
Maize (dunged plots) ...	17.50	14.02	17.85	14.90	18.33	16.65	20.80	18.63

***Note.**—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate at the rate of 250 lbs. per acre at the beginning of 1928-29 season. One-half of the plot was then planted to maize while the other half was sown to a mixture of sunn hemp and velvet beans, which were subsequently ploughed in. This manurial treatment was repeated on the respective plots during the season 1932-33.

†In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Beans for Hay."

System A.—The beneficial effect which the green manurial treatment had on this land was strikingly demonstrated on this plot this season. Both sections received a dressing of 250 lbs. per acre of bone and superphosphate last season, and the one on which maize only has been grown has yielded 12.27 bags per acre for the two seasons, whereas the section which was green-manured last year has exceeded that amount by 6.77 bags per acre in the first season after the green manurial treatment. The average annual yield of this land during the six seasons which preceded the change to the green manure and phosphate treatment was 3.66 bags per acre. Since that time where phosphatic fertiliser alone has been used the average yield has increased to 7.30 bags per acre, and the green manure has added a further 2.22 bags per acre per annum to the yield of this land. It is seen therefore that during the six-year period 1929-34 the four crops from the green-manured land have returned a total of 13 bags per acre more than the 6 crops from the land which has received fertiliser only. When the low cost of green manuring is considered it will be plainly seen that it is more economical to combine green manure with applications of phosphatic fertiliser than to use fertiliser alone.

System B.—The maize yield in this system is much smaller than that of any of the others. This is probably largely due to a lack of phosphate, but the lack of vigour of the preceding crop of dolichos beans, as the result of insect attack, must also be taken into account. Commencing this season the dolichos beans are being replaced by a mixture of soya and velvet beans. It is expected that the change will result in a more vigorous growth of the bean crop, which may in turn have a more beneficial effect on the maize crop which follows. On the other hand, a heavier bean crop may make larger demands on the available phosphate in the soil, and in that way cause a decrease in the maize crop which follows. The yield of hay was nearly two tons per acre, which is nearly double that of the heaviest dolichos bean crop taken from this land during the past four years.

System C.—The advantage conferred by rotational cropping is well demonstrated by this system. In spite of this land having been continuously cropped for a period of over

twenty years without the addition of manure or fertiliser, a yield of 10.75 bags per acre of maize was obtained this season. Reference to the figures for previous seasons shows, however, that the yields are gradually lessening, and this indicates that although rotational cropping is a very efficient means of stabilising yields, it cannot replace all of the plant foods which the crops remove from the soil. A balanced system of rotational cropping reinforced by applications of farmyard manure or fertiliser is therefore necessary to keep the fertility of the land at an economical level.

System D.—The high yields which have been consistently obtained from the maize plots in this rotation prove that the system is based on sound principles. The application of farmyard manure is equal to one and a half tons per acre per annum only, but that small amount, coupled with diversified cropping, has kept the fertility level surprisingly high. Regardless of seasonal influences the yields in this group have remained fairly constant between 14 bags and 17 bags per acre, while those of the adjoining plots which are cropped to maize continuously have fluctuated between 2 bags and 10 bags per acre, according to whether the season happened to be favourable or otherwise. The lowest yield recorded in this system during the 17-year period 1918-34 is 11.25 bags per acre. This shows that even in adverse seasons fairly good crops may be obtained when a properly balanced system of cropping is followed. A good crop in an unfavourable season will have a proportionately higher monetary value locally than a heavy crop in a favourable season, because the scarcity of a commodity usually increases its monetary value. It is seen therefore that the average value of the maize produced in System D may be placed somewhat higher than that of the maize produced in Systems A2 and B. Hence when comparison is made on a monetary basis the difference in favour of the balanced system is actually greater than the figures denoting yields per acre indicate.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series included two plots, A. and F., on which maize was

grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of Plot A. continues as in the past, but on Plot F., commencing season 1929-30, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quantity and quality as that accorded in rotational System H, but green manuring is entirely omitted.

Plot A: System E.—Maize continuous without manure or fertiliser:—

Seasons and Yields of Maize in Bags per Acre.

1933-34.	1932-33.	1931-32.	1930-31.	1929-30.	1928-29.	Average over 15 years.
4.60	1.74	11.60	2.33	7.85	7.65	10.30

In spite of a favourable season the yield of this plot is very low, and at the present price of maize the crops produced on this land would not give an economic return. It is evident that the original store of available plant nutrients is now almost exhausted, but it is interesting to note that a yield of some 155 bags per acre of maize have been obtained from this land during the fifteen years it has been under cultivation, although no manure or fertiliser has been used.

Plots B to E: System F.—Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19 per cent. P_2O_5).

Maize Yields in Bags per Acre.

	1933-34.	1932-33.	1931-32.	1930-31.	1929-30.	1919-20.	Average 1920-34.
Plot B Sudan	9.72	22.65*	9.10†	Sudan g.	26.0	17.84	
Plot C 15.45	10.75*	19.33†	Sudan g.	13.33	23.7	15.33	
Plot D 18.80*	11.05†	Sudan g.	9.10	15.78*	Sudan g.	16.64	
Plot E 17.73†	Sudan g.	19.23	13.42*	13.90†	24.6	16.74	
Average	17.33	10.51	20.41	10.54	14.34	24.7	16.64

*Indicates the application of farmyard manure.

†Indicates the application of 200 lbs. per acre superphosphate.

The effect of the favourable climatic conditions which prevailed during the season under review are again revealed in the yields of these plots, as they are considerably higher than those for the previous season. In fact they are higher than they have been at any time since the dressing of fertiliser was introduced into the system 5 years before, with the sole exception of the season 1931-32, when the climatic conditions were exceptionally favourable. While it is as yet too early accurately to gauge the effect of the addition of fertiliser to supplement the kraal manure in this system, the yields of the past few years indicate that it has retarded the downward trend which was revealed by the yields before its introduction.

Plot F: System G.—Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

Seasons and Yields of Maize in Bags per Acre.

1933-34.	1932-33.	1931-32.	1930-31.	1929-30.	1919-20.	Average over 15 years.
14.55*	5.33	21.08*	7.03	6.38*	23.3	11.83

*Indicates the application of 200 lbs. per acre fertiliser.

The addition of fertiliser has made a striking difference to the yields of this plot. The average yield for the four-year period 1927-30 was 6.73 bags per acre, but since that period fertiliser has been used and the yield has increased to an average of 12 bags per acre per annum. It will be seen, however, that there are wide fluctuations between the yields of the various seasons, showing that this system is highly susceptible to seasonal influences, and is therefore inferior to the more stable systems.

Plots G to K: System H.—Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility,

and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop, that immediately in front of the green crop, receives 200 lbs. per acre of a mixture of bone meal and superphosphate.

Maize Yields in Bags per Acre.

	1933-34.	1932-33.	1931-32.	1930-31.	1929-30.	1919-20.	Average 1920-34.
Plot G	Beans	5.94*	12.75	16.80*	Beans	23.10*	14.78
Plot H	14.50*	9.32	22.45*	Beans	10.70*	23.00	15.53
Plot J	12.25	10.65*	Beans	6.10*	7.57	Beans	14.41
Plot K	19.65*	Beans	16.50*	7.53	16.00*	19.20	15.16
Average	15.47	8.63	17.23	10.14	11.42	21.70	14.97

*Denotes application of fertiliser.

At the time this system was amended to include two dressings of fertiliser instead of one during each four-year period, it was anticipated that the application of fertiliser to the maize crop immediately preceding the green-manure crop would increase the amount of material available for ploughing under, and result in a satisfactory maintenance of soil fertility over the whole of the four-year period. The yields of maize obtained during the five years which preceded the alteration in the manurial system and those for the succeeding five years are shown in the following tabulation.

These returns show that in spite of the inclusion of an additional dressing of fertiliser during the second five-year period, the average yields were somewhat less than they were during the previous period. The change in the incidence of the fertiliser applications does not appear to have extended the period over which the green manure exercises a beneficial effect on the crops of maize which follow. The effect of the green manure is very pronounced in the first season and the second crop derives some benefit also, but its effect is very small during the third season.

Yields of Maize in Bags per Acre.

Season.	First crop after green manure. (No fertiliser)	Second crop after green manure. (+ 200 lbs. bone supers)	Third crop after green manure. (No fertiliser)
1924-25	15.65	19.85	6.65
1925-26	20.20	15.80	13.80
1926-27	17.90	14.70	14.20
1927-28	14.40	14.50	7.80
1928-29	17.50	9.00	8.75
Five-year average	17.13	14.77	10.24

Manurial system changed.	(+ 200 lbs. Superphosphate)	(No fertiliser)	(+ 200 lbs. Bone super)
1929-30	16.00	10.70	10.70
1930-31	16.80	7.53	6.10
1931-32	22.45	12.75	16.50
1932-33	10.65	9.32	5.94
1933-34	19.65	12.25	14.50
Five-year average	17.11	10.51	10.75

The beneficial effect of green manure is again strikingly illustrated by this rotation. Comparison with the yields obtained in System F shows that the effect of green manure is equal to that of a dressing of 8 tons per acre of kraal manure in the first season after its application, but that while the effect of the kraal manure continues over the whole four-year period, the benefit derived from the green manure is almost exhausted in two years.

In the tabulation below are shown the mean yields of the crops of maize obtained in the four systems of this series during the first, second and third five-year periods which have elapsed since the commencement of this experiment.

Yields of Maize in Bags per Acre.

Periods of five years.	System E.	System F.	System G.	System H.
First, 1920-24 ...	17.20	17.40	16.15	18.28
Second, 1925-29	8.07	15.77	8.46	14.04
Third, 1930-34 ...	5.62	14.62	10.87	12.58

The yields obtained during the first five years show that the original level of fertility was uniformly high in all of the various systems, and heavy yields were obtained regardless of the method of treatment. During the second period the yields of the Systems E and G, in which the land received no manure or fertiliser, were reduced to one-half of those for the first period, but the returns in Systems F and H, though somewhat reduced, were fairly well maintained. The continued decrease of the yields in these systems during the third period indicates that, in spite of the increase in the amount of fertiliser supplied since the season 1929-30, the amount of plant food which is being added to the soil in the form of manure and fertiliser is still less than the amount removed by the crops. The continued decline in the yields from System E is the natural result of continued cropping without the support of manurial treatment. In System G the applications of phosphatic fertiliser, which were commenced in the season 1929-30, have given remarkably good results. The yields from this land are equal to those obtained in System H, where fertiliser is applied in the third year after the green manurial treatment. Neither green manure nor farmyard manure has ever been applied to this land, and these results would appear to confirm the conclusions drawn from the yields in System H, *viz.*, that the beneficial effect of green manure is practically exhausted during the first two seasons following its application.

Comparison of the Effect on Succeeding Crops of Maize of Ploughing Under Green Sunn-hemp versus Burning the Mature Crop of Sunn-hemp on the Land.—A number of farmers in the Arcturus District have persistently reported that their yields of maize following the burning of mature crops on Sunn-hemp are as large, or even larger, than those of crops on adjoining land where the Sunn-hemp had been ploughed under in the usual way. These reports have given rise to no little surprise, in view of the fact that the practice of green-manuring has been increasingly adopted by the farmers in nearly every district in the Colony, who are thoroughly convinced of its efficacy as a means for the production of larger and more profitable crops.

A number of theories in support of burning the Sunn-hemp have been put forward, such as that the burning may cause a temporary increase in nitrogen-fixing bacteria in the soil, as shown by Russell and others at Rothamsted, or liberate essential nutrients which would otherwise remain unavailable to succeeding crops, or that the potash in the ash of the burnt crop may supply a shortage in the soil and so stimulate the growth of the young maize and enable it to maintain its lead over the crop on the land on which the green material had been ploughed in.

Investigations were commenced in the season 1930-31 when a crop of Sunn-hemp was treated in three different ways, namely:—

- (a) ploughed under for green manure when the first pods formed;
- (b) mature crop burned on the land;
- (c) ash returned to the land after the mature stalks had been burned elsewhere, to avoid the partial sterilising effect (if any) of burning the crop on the land.

Each method of treating the Sunn-hemp was replicated ten times.

The yields of the plots during the past three seasons are tabulated below:—

Reference to the seasonal totals in this tabulation show that in the first season the yield from the plots on which the Sunn-hemp was ploughed under was 82 lbs. more than the average for the two other treatments, and during the third season the yield was 86 lbs. in favour of the green-manured plots. It has been shown by experiments cited above that the benefit from green manurial treatment is largely exhausted by the first two maize crops which follow its application, but in this case we find a surplus in the third season which is as large as that of the first season. It would appear therefore that the increased yields obtained in this experiment in favour of ploughing under the Sunn-hemp may be due to fortuitous circumstances rather than to the treatment. It is probable that the natural fertility of the plots on which the Sunn-hemp was ploughed under happens to be somewhat higher than that of the other plots. These results therefore

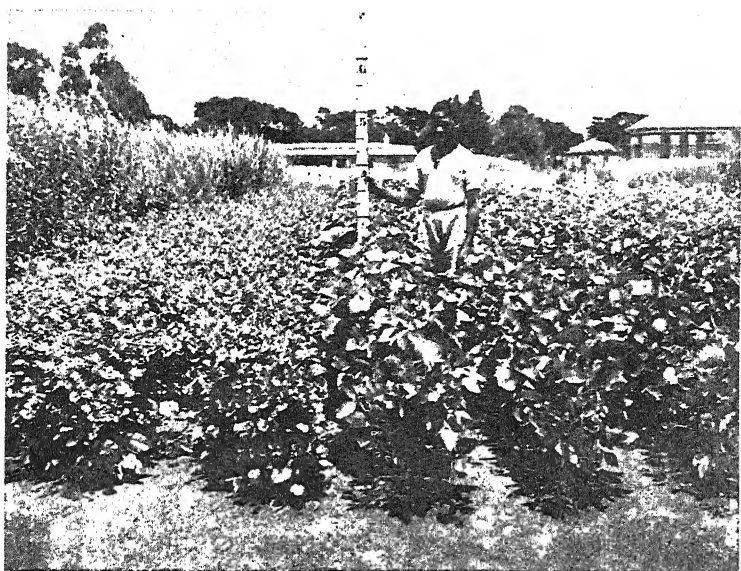
do not definitely indicate that anyone of these methods of treating the Sunn-hemp crop is superior to the others, in so far as their effect on the following maize crops is concerned. It is thought, however, that in most cases it will be found to be more economical to utilise the soil renovating crop by ploughing it under than by burning it.

Yields of Maize in lbs. per Plot of 1/30th Acre.

Sunn-hemp. Ash only.			Sunn-hemp. Burned on the land.			Sunn-hemp. Ploughed under for green manure.		
1931-32.	1932-33.	1933-34.	1931-32.	1932-33.	1933-34.	1931-32.	1932-33.	1933-34.
160	87	103	166	93	82	151	92	97
145	79	102	161	64	86	170	77	94
164	82	100	166	99	98	174	87	106
173	76	82	157	92	86	191	96	120
159	110	102	166	90	85	171	109	93
161	78	105	142	72	95	182	79	123
159	60	102	158	66	116	140	66	106
143	44	102	134	62	115	135	49	109
138	55	100	116	35	102	123	41	101
111	51	94	135	50	95	151	61	113
Seasonal								
totals ...			1,511	722	992	1,501	723	960
Treatment totals						1,588	757	1,062
3 seasons			3,225		3,184	3,407		

Wide-spacing between Rows of Maize versus Normal Spacing.

—These experiments were commenced in the season 1930-31, at which time a number of local farmers believed that the practice of planting maize in rows as wide as 9 feet apart might prove more economical than planting at the usual distance of 36 inch to 42 inch between rows, provided that by closer planting in the rows the same number of plants per acre are established. Those who favoured this method maintained that considerable economy would be effected by the saving of labour for planting, weeding, etc., and that the acceleration of these operations would more than compensate for any small reduction of yield which might occur. Further,



Cowpeas (left) and Soya Beans (right). An upright variety of cowpea known as Poona and Otxoi Soya Beans. Both are very valuable fodder crops and drought resistant.



"Biltan" Soya Beans. This selection has yielded very heavy crops of hay during the past four seasons. It thrives in both wet and dry seasons.



Somerset Velvet Beans. A valuable leguminous fodder crop. Thrives well in all parts of the Colony and in all seasons. Yields much heavier crops than any other legume grown in Rhodesia.



Pyrethrum on dry land. A few plants produced a satisfactory crop of flowers. One of these is shown above surrounded by flowerless plants.

a catch crop of haricot beans or a hay crop could be planted on the space between the rows at the last cultivation to make use of the vacant land not utilised by the maize crop. These trials included five different spacings, namely, the standard spacing of 3 feet by 18 inches, and 6 feet by 9 inches; 9 feet by 6 inches; 9 feet by 9 inches with the hay crop sown between the rows at the last cultivation.

The following tabulation shows the average yields obtained from quadruplicate plots during the season 1932-33 and 1933-34 and the averages of similar trials during the two previous seasons.

Yields of Maize in Bags per Acre.

Distance of Planting.	No. of plants. per acre.	Season 1933-34.	Season 1932-33.	Season 1930-31.	Average 4 Seasons (18 plots)
3 ft. x 18 ins.	9,680	22.14	16.61	20.61	20.11
6 ft. x 9 ins.	9,680	22.48	16.55	20.33	20.00
9 ft. x 6 ins.	9,680	19.03	16.00	17.24	17.35
9 ft. x 9 ins.	6,453	17.75	15.50	16.23	16.39
9 ft. x 9 ins. + Beans		17.18	15.59	15.49	15.86

These results show that although there was little difference in yield between the standard spacing of 3 ft. x 18 ins. and the somewhat wide spacing of 6 ft. x 9 ins., there was a decrease of 13 to 18 per cent. when the space between the rows was widened to 9 feet. A further reduction in yield took place as a result of the space between the plants in the widely-spaced rows being increased to 9 inches instead of 6 inches, and the competition caused by the sowing of cow-peas and soya beans between the rows of maize after the last cultivation at the end of January was responsible for a further decrease in the yield of maize. In this case the maize yielded under 80 per cent. of the yield obtained from the normal spacing. The amount of dry fodder produced by the bean crop was very small, averaging only half a ton per acre. The collection of the hay from between the rows of maize would require a larger expenditure for labour than the harvesting of a normal crop from the open land, and it is doubtful therefore whether the small crop of hay obtained by the former method would compensate for the loss in yield of maize, and the cost of seed and labour involved in its

production. It is also obvious that the growing of another crop between the maize where witchweed infests the soil will handicap the maize unduly, and also render it much more difficult to destroy the parasite.

It appears, therefore, that there is nothing to be gained by spacing the rows as far as nine feet apart, except perhaps for the farmer whose lands consist largely of clay soil, the cultivation of which is difficult when wet weather prevails. On the whole, however, the practice of excessive wide spacing does not seem to have much to recommend it to the farmer who is purely a maize grower.

The Effect on the following Crop of Ploughing under Maize Trash.—The results of previous trials were included in last season's report of experiments, when it was shown that over a period of three seasons the incorporation of maize trash with the soil had resulted in neither a harmful nor a beneficial effect on the succeeding crop.

These experiments were continued during the season under review when four plots were dressed with maize trash at the rate of one ton per acre and on a further four plots trash at the rate of three tons per acre was applied. The trash consisted of maize stalks and leaves of the previous season's crop, and these were chaffed in a silage cutter to ensure a more even distribution of the material in the soil. It was ploughed under a few weeks before the crops were sown. For each treated plot an adjacent untreated control plot was provided. One half of each of the plots was sown to maize and the remaining half to ground nuts.

It is seen that, in the case of maize, the eight plots which were dressed with trash yielded a total of 612 lbs., and that the eight adjacent control plots produced exactly the same amount. The yield from the ground nuts was also practically the same on both the treated plots and those which did not receive the trash.

The results this season, therefore, corroborate those of previous experiments by indicating that the incorporation of raw maize trash with the soil neither increases nor decreases the productive capacity of the land in the case of the maize and ground nut crops. They also support the observations

made in regard to the comparative ineffectiveness of the top growth of Sunn-hemp when it is ploughed under as green manure to increase the following maize crop more than the residue of the mature stalks when they are burned on the land, and it also raises the question as to whether it might not be found more profitable to first compost such vegetable matter instead of incorporating it with the soil in its raw state.

Yields in lbs. of (a) Maize, (b) Ground Nuts, per Plot of 1/64 Acre.

MAIZE.				GROUND NUTS.			
Trash. One ton per acre.	(No Control. trash).	Trash. Three tons per acre.	(No Control. trash).	Trash. One ton per acre.	(No Control. trash).	Trash. Three tons per acre.	(No Control. trash).
68	65	74	59	12	10	12	24
72	79	73	68	15	17	24	17
78	89	82	88	24	20	15	14
82	87	83	77	18	24	25	27
Totals 300	320	312	292	69	71	76	82

Catch-crops on Green-manured Land.—These trials were commenced in the season 1931-32 following numerous enquiries from farmers who wished to grow a catch-crop immediately after their green manure crop had been ploughed under. These farmers feel that they need a quick maturing crop which is capable of yielding a return on their expenditure during the current season instead of having to wait until the following season's crop has been harvested.

Owing to the limited period during which rain may be expected it is obviously necessary for the first crop to commence its growth early in the season in order that it may attain as nearly as possible to its normal maximum growth and exert its beneficial influence on the soil before being ploughed under, and this operation must take place sufficiently early in the season to allow the second-crop to reach maturity, or at least to make sufficient growth to warrant its conversion into hay or silage.

When it is intended to produce a catch-crop, therefore, the green-manure crop should be sown in October or early in November in order that growth may commence with the first rains. In normal seasons Sunn-hemp and sunflowers will be sufficiently advanced to allow of their being ploughed under during the latter half of the month of January. Investigations in other countries have shown that better germination of the seed and subsequent growth of the catch-crop is obtained when seeding is delayed for two or three weeks after the green manure has been ploughed under, but in this Colony a delay of two or three weeks between ploughing and seeding the next crop would, in most seasons, considerably reduce the chance of success by curtailing the growing period which, to begin with, is rather too short for the majority of our crops. It has been observed that the seedlings of the catch-crop often suffer from attacks of various terrestrial insect pests to a greater extent than the crops sown at the beginning of the season, and when cutworms or other insects are present it may be found advisable to delay sowing the catch-crop for a few days in order that the land may be treated with poison bait to destroy the pests before the second crop has germinated.

During the season under review the green manure was ploughed under on January 20th, 1934, and the catch-crops were sown two days later. These consisted of sunflower, S.E.S. oats, Poona cowpeas, haricot beans, and Peter Pan culinary peas. Little rain fell after February 14th, and in consequence the growth of the crops was considerably curtailed. The haricot beans were attacked by cutworms and stem weevil. These pests reduced the stand by 50 per cent. and were largely responsible for the yield of dry beans being as low as 286 lbs. per acre. The Peter Pan peas were severely attacked by insects as well as a leaf spot disease, which together reduced the yield to a few pounds only. The cowpeas failed through insect and fungoid disease attacks, leaving the sunflowers and S.E.S. oats as the only crops, whose yield was sufficient to justify the trouble and expense incurred. On May 18th the sunflowers were cut for silage and their yield was found to be six and a half tons per acre of green fodder, and on the same date the S.E.S. oats gave a yield of two and a half tons of green fodder per acre.

These results corroborate those of previous seasons in showing that both the sunflowers and the S.E.S. oats are remarkably drought-resistant crops, for although really effective rains terminated within two weeks of the date on which these crops appeared above ground, they were sufficiently hardy to withstand both drought and heat and yielded a fair crop of very valuable fresh fodder suitable for feeding to livestock at a time of the year when green fodder is usually scarce.

Ground-nut Fertiliser Trials.—Yields of ground nuts as large as 45 bags per acre have been obtained by a number of farmers in this Colony, and in the trials conducted at this Station yields of 30 bags per acre of 75 lbs. each are not unusual, though in the same season, on other plots, as few as ten or fifteen bags per acre have been recorded. It is therefore apparent that, apart from climatic influences, the condition of the soil has a direct bearing on the weight of the crop of these nuts. Nearly all farm crops, as well as fruit and forest trees, respond to applications of farmyard manure and chemical fertilisers, particularly when the fertility of the land has been reduced by continuous cropping, and it might reasonably be expected that the ground nut crop would respond in a similar manner. Although trials with farmyard manure and various chemical fertilisers have been made over a period of several years, at no time has the increased yield been large enough to justify the expenditure incurred for either fertiliser or farmyard manure.

Previous experiments having shown no response from dressings of nitrogenous and potassic fertilisers our experiments during the past two seasons have been confined to the use of superphosphates, the difference in the amount used, and the method of applying it, forming the basis of the experiment.

The treatments were as follows:—

- (1) 200 lbs. per acre superphosphate broadcast.
- (2) 200 lbs. per acre superphosphate applied in the seed drills.
- (3) 400 lbs. per acre superphosphate applied in the seed drills.
- (4) No fertiliser.

One half of each of the plots was sown to the Valencia and Virginia Bunch varieties respectively. The results are shown in the following table:—

Yields in lbs. of Ground Nuts and Hay per Plot of 1/32 Acre.

VALENCIA VARIETY.

Treatments.	200 lbs. per acre Supers Broadcast. Nuts. Hay.		200 lbs. per acre Supers in drills. Nuts. Hay.		400 lbs. per acre Suptrs in drills. Nuts. Hay.		No. fertiliser. Nuts. Hay.	
Block No. 1 ...	70	57	80	63	75	63	72	51
Block No. 2 ...	84	68	75	56	71	65	81	66
Block No. 3 ...	76	55	79	58	81	62	71	48
Block No. 4 ...	75	58	78	61	76	40	88	58
Totals	305	238	312	238	303	230	312	223

VIRGINIA BUNCH VARIETY.

Treatments.	200 lbs. per acre Supers Broadcast. Nuts. Hay.		200 lbs. per acre Supers in drills. Nuts. Hay.		400 lbs. per acre Suptrs in drills. Nuts. Hay.		No. fertiliser. Nuts. Hay.	
Block No. 1 ...	79	91	82	79	88	83	83	65
Block No. 2 ...	88	87	78	77	75	87	80	85
Block No. 3 ...	78	78	79	74	85	94	75	79
Block No. 4 ...	71	71	68	67	79	81	84	74
Totals	316	327	307	297	327	345	322	303

These results confirm previous experiments in showing that the fertiliser has had scarcely any effect on the crop, and that although by placing the fertiliser in the drills it was brought into direct contact with the roots of the plants, no better results were obtained than by broadcasting the fertiliser over the whole area. There appears to have been a slight increase in the top growth on the Virginia Bunch plots, where 400 lbs. per acre of superphosphate was applied in the drills, but the gain recorded is only 336 lbs. per acre, and the value of that amount of hay would not balance the expenditure for the fertiliser.

This season's results corroborate those of previous years in showing that the ground nut crop does not respond to applications of superphosphate after the manner of many other crops.

Ground-nut Distance-planting Trials.—During recent years enhanced values have been obtainable on the overseas markets for nuts of large size and good colour, and the question has arisen as to whether it might not be possible to obtain a larger proportion of large nuts by allowing the individual plants a larger area than the standard spacing provides. Previous experiments had shown that the heaviest yields were obtained when the plants were spaced at six inches apart in rows eighteen inches apart. In field practice it is usual to space the rows twenty-four inches or even further apart, in order to facilitate weeding the crop. For the purpose of these investigations 24 in. x 6 in. is considered the standard espacement for comparison with three others, namely, 24 in. x 9 in.; 24 in. x 12 in. and 30 in. x 9 in. These trials include both the Valencia and Virginia Bunch varieties.

In the following tabulations are shown the yield of nuts and hay from each plot. All the various espacements are represented by four plots of each variety.

Yields of Ground Nuts in Bags (75 lbs.) per Acre.

VALENCIA VARIETY.

Planting distance	24 in. x 6 in.		24 in. x 9 in.		24 in. x 12 in.		30 in. x 9 in.	
Season.	1932-33.	1933-34.	1932-33.	1933-34.	1932-33.	1933-34.	1932-33.	1933-34.
Block No. 1 ...	15.8	22.7	15.6	21.3	13.3	27.1	12.9	21.3
Block No. 2 ...	14.0	26.4	13.1	26.4	13.1	23.2	12.8	24.9
Block No. 3 ...	16.2	27.1	16.2	27.9	11.6	27.1	13.0	23.2
Block No. 4 ...	11.1	28.6	11.6	27.1	9.2	23.2	9.9	22.0
Totals of 4 plots	57.1	104.8	56.5	102.7	47.2	100.6	48.6	91.4
Average 4 plots	14.3	26.2	14.1	25.7	11.8	25.1	12.2	22.9
Av. 2 Seasons	20.25		19.9		18.5		17.6	

Yields in Bags of 75 lbs. per Acre.

VIRGINIA BUNCH VARIETY.

Planting distance	24 in. x 6 in.		24 in. x 9 in.		24 in. x 12 in.		30 in. x 9 in.	
Season.	1932-33.	1933-34.	1932-33.	1933-34.	1932-33.	1933-34.	1932-33.	1933-34.
Block No. 1 ...	27.2	22.5	29.6	25.7	26.0	24.9	24.0	22.0
Block No. 2 ...	28.3	34.6	26.6	29.5	26.6	29.9	23.7	27.7
Block No. 3 ...	25.4	29.6	24.9	28.8	21.8	26.7	20.2	22.6
Block No. 3 ...	25.4	29.6	24.9	28.8	21.8	26.7	20.2	22.6
Block No. 4 ...	21.8	29.7	24.2	27.0	23.7	32.5	22.1	25.8
Totals of 4 plots	102.7	116.4	105.3	111.0	98.1	114.0	90.0	98.1
Average of 4 plots	25.7	29.1	26.3	27.8	24.5	28.5	22.5	24.5
Av. 2 Seasons	27.4		27.0		26.5		23.5	

These trials confirm the results of previous experiments in showing that close-planting conduces to high acre-yields, and that the Virginia Bunch variety yields heavier crops than Valencia. In addition to the nuts, somewhat larger quantities of hay were obtained from the closely planted plots.

The nuts reaped from each plot of the Valencia variety were graded into three sizes as follows:—

Grade I.—Sound nuts over $1\frac{1}{2}$ inches long. This grade included nearly all of the nuts which contained three or more kernels.

Grade II.—Nuts between $1\frac{1}{2}$ inches and $1\frac{1}{4}$ inches long. All of the short three-kernelled nuts, and most of those containing two kernels were included in this grade.

Grade III.—Nuts less than $1\frac{1}{4}$ inches long and damaged nuts.

The following table shows the percentages of the total yields of nuts obtained from each method of planting, after division into their respective grades.

Percentages of Total Yields. Valencia Variety.

Grade.	Distance of Planting.			
	24 x 6 in.	24 x 9 in.	24 x 12 in.	30 x 9 in.
	%	%	%	%
I. Over 1½ inches ...	42	38	37	36
II. Between 1½ inches and 1¼ inches ...	26	30	32	32
III. Under 1¼ inches	32	32	31	32

These results show that a slightly higher proportion of first grade nuts was obtained from the closely planted plots, and that the proportion of Grade I. nuts decreased as the distance between the plants increased. The position was reversed in the case of the second grade nuts, however, and it was found that the total yields of Grades I. and II. nuts were practically the same for all the various spacings, viz., 68 per cent.

Owing to the difference in the size and shape of the nuts, it was found that the method of grading the Valencia variety could not be adopted for the Virginia Bunch variety, and these were divided into two grades only, namely:—

Grade I.—Large, sound two and three-kerneled nuts.

Grade II.—Small mis-shapen and damaged nuts.

Percentages of Total Yields. Virginia Bunch Variety.

Grade.	Distance of Planting.			
	24 x 6 in.	24 x 9 in.	24 x 12 in.	30 x 9 in.
	%	%	%	%
I. Large, two and three-kernelled nuts ...	59.5	60.6	57.4	53.3
II. Small and damaged . .	40.5	39.4	42.6	46.7

In this variety also it was found that a larger proportion of large nuts was obtained from the closely-planted plots than from the others. Therefore, there appears to be no advantage to be gained by planting wider than 24 in. x 6 in. on red soils, as no improvement either in quantity or quality can be obtained in that way.

Pyrethrum.—Interest in this crop has been stimulated by the reports of its successful cultivation in Kenya Colony. Climatic conditions here, however, differ considerably from those of other countries where pyrethrum is grown for commercial purposes.

With the object of finding whether the crop could be grown under local conditions, seed of improved strains of *Pyrethrum cinerariaefolium* was obtained through the courtesy of the Director of the Plant Pathological Laboratory of the British Ministry of Agriculture. This was sown in nursery beds in September, 1931; and the resulting plants were large enough for transplanting to permanent quarters during the following December. A part of this stock was planted in beds which could be irrigated, and the remainder was planted in the open where the plants received no artificial supplies of water.

Irrigated Pyrethrum.—With the exception of a few scattered flowers, the first main crop from these plants was obtained during October and November, 1932, when a yield of 55 lbs. per acre of dried flowers was obtained. In the following season the yield increased to 230 lbs. per acre, but last season only 112 lbs. per acre were reaped.

Dryland Pyrethrum.—The plants in this plot were spaced about 36 inches by 18 inches apart, or twice as far between the rows as those under irrigation, in order to allow of the use of a cultivator between the rows and to assist the plants to withstand the effects of the long winter drought. These plants have not received artificial irrigation at any time and have therefore been compelled to struggle unaided against the severe and prolonged droughts which are normally experienced in this Colony during the winter months. During August, 1932, exceptionally heavy rains, totalling two inches, were recorded, and these seemed to assist the crop very considerably by enabling them to continue their growth until the regular rains arrived in November. The main crop of flowers were produced throughout the month of January, 1933, and they were collected twice weekly and dried. The total weight of these flowers was at the rate of 80 lbs. per acre. The absence of rain during the winter season of the year 1933 appears to have had an unfavourable effect on this crop, as the plants

were much weaker after the winter season had passed than they were at any previous time. A number of the plants succumbed, and although the survivors appeared to regain health and vigour soon after the arrival of the summer rains, only about 25 per cent. produced any flowers, and most of these gave a sparse crop. The yield was only 12 lbs. per acre of dried flowers.

Although the general crop failed there were one or two outstanding plants which produced a large quantity of flowers. Whether their exceptional production was due to inherent qualities or merely to local conditions of soil, is not known; but the seed of those plants was saved for future sowing, as it is hoped that it may be possible to establish strains which are suitable for field cultivation under local conditions.

EGG MARKETING BILL.

DRAFT OF A BILL HAVING FOR ITS PURPOSE THE MORE ORDERLY MARKETING OF EGGS.

The general position of the Poultry Industry in Southern Rhodesia of recent years has caused considerable anxiety both to producers and to the Department of Agriculture. A period of marked expansion in 1930-31 was followed by an acute depression during 1932-33, when considerable numbers of poultry keepers went out of production on account of the low prices realisable for eggs. More recently while surpluses have been produced in the flush season, scarcity of supplies, accompanied by high prices to consumers, has been experienced in winter, entailing considerable imports of eggs from the Union of South Africa. Present indications denote that the industry is expanding once again, and it is not unlikely that before long surpluses in excess of local requirements of eggs will be produced, which may well necessitate export overseas in the flush period of the year.

Various schemes to achieve a more orderly system of marketing have been submitted to the Department of Agriculture for consideration, by leaders of the industry, but for reasons explained by the Director of Trade and Industry in his following memorandum the egg industry is a difficult one to which to apply a system of regulated marketing, largely on account of the keeper of poultry for home use, and the native producer, who enter the market in the flush season and thereby aggravate an already over-supplied market.

Proposed voluntary agreements between producers and merchants have not fully materialised, and finally after numerous discussions with those interested the Minister of Agriculture and Lands decided to request the Director of Trade and Industry, in consultation with the officers of the Department of Justice and the Poultry Officer, to submit a draft Bill having for its object the orderly marketing of eggs within the Colony.

It is believed that the Bill published in this issue of the *Rhodesia Agricultural Journal* is in essential details approved by a considerable number of producers. The normal course to adopt in the case of such proposed legislation is to publish the Bill in the *Government Gazette* prior to the session of Parliament at which it will be presented. In the present instance, however, it is desired that all interested producers, merchants dealing in eggs and consumers, should have the fullest opportunity of considering and discussing the implications of a legislative enactment which either in the form now submitted or in a somewhat similar form seems likely to become desirable at no distant date.

It must be emphasised that the Government does not intend to proceed with the Bill in its present or in an amended form, until there is a general demand for it, but in the meanwhile it is hoped that all those in the Colony concerned in the production and marketing of eggs will give the question their very full and thoughtful consideration.

H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

27th August, 1935.

MEMORANDUM ON THE DRAFT EGG MARKETING BILL.

By E. R. JACKLIN, Director of Trade and Industry.

The draft Bill, which follows, is the outcome of an instruction to prepare a scheme by which the price received by the egg producer—and the price paid by his customer—could be regulated at a figure which the Government may consider reasonable and fair to both parties.

The administration of market regulation in the case of a highly perishable product like eggs presents special difficulties. The system which best avoids or combats these difficulties, a general pool on the English model, seems in local

circumstances neither desirable nor practicable, both because it involves compulsory delivery of eggs to central depots and because the egg business is carried on in certain districts in circumstances which make it desirable to have a flexible system which does not interfere with local conditions and the local course of trade.

In these circumstances it has been the endeavour to present a system which, while giving in large part the effect of a general pool, will not interfere with the free course of trade. The proposals embodied in the draft Bill will in fact—

(a) leave the producer's choice of a market legally untrammelled so that he will retain absolute discretion as to whom and at what price he sells;

(b) avoid direct and arbitrary interference with the existing course of trade and such incidents to it as the merchants' contra account system;

(c) enable the effect of price regulation at places distant from the central markets to be tempered or eliminated where desirable without giving the loss of control and the administrative difficulties which result from statutory exemption;

(d) maintain any geographical advantage enjoyed by producers in relation to particular markets; and

(e) avoid increased inducement to producers in outlying districts to deprive local customers of supplies by transferring their eggs to the central markets.

The essential features of the scheme are given in the following paragraphs:—

Board of Control.—A Marketing Board is to be established consisting of two producer representatives, two commercial men and one Government representative (Section 4).

Right to Sell and Buy Freely.—The producer is to have the right to sell to whom he likes or at his option to deliver any of his eggs to the Board (Section 6). The public's right to purchase from any producer or native will be equally unrestricted. A purchaser will not, however, be allowed to surrender any of the eggs he acquires for participation in the Board's pools, as the producer may do.

Monthly Returns.—The producers will furnish monthly returns showing to whom they sold, the quantity and the date of the transaction (Section 7 (1)). A return giving similar details of purchases from producers and natives will be required from merchants and certain classes of large consumers who buy direct from producers (Section 7 (2)). Only one simple return a month will be required. Their purpose will be apparent later when the levy clauses are discussed. They will be cross-checked so that evasion of the control will not be possible without the collusion of both producer and purchaser.

The classes of consumers from whom a return of purchases from producers will be required will be prescribed by regulation and may include hotels, hostels, messes, etc. The householder will not be affected in any way. For information regarding the purchases of small consumers direct from producers, the Board will rely on the returns from the producers.

The returns specified will give the Board a record of the eggs sold by producers. Natives are not treated as producers. They do not sell eggs to any extent; but when they sell to traders or large consumers the purchaser's return should show the quantity.

Board's Pool.—The Board will operate a monthly pool or a series of periodic pools of the eggs which producers choose to surrender to it for sale and will be prepared to sell from such pools to merchants and "wholesale purchasers" at a price which will be subject to the Minister's general approval. The Board will also undertake any necessary export of surpluses and ensure so far as possible that valuable markets in neighbouring territories are retained and developed.

The various powers incidental to the operation of pools are provided in Section 12.

Levy on Purchases.—We come now to the purpose of the returns from producers, etc. It is proposed that merchants and such large consumers as are required to furnish returns will pay a levy or contribution to the Board's pool on the purchases they make from producers and natives (Section 8

(1)). In the case of sales by producers to householders and small consumers who are not required to furnish returns, the contribution will be collected from the producer. Section 9 (1)).

The amount of the contribution will be the difference between the Board's selling price in the place and at the time concerned and the price distributed by the pool of the period. (Section 8 (2) and 9 (2)). This arrangement will give as closely as possible the financial effect of a general pool. The matter needs close explanation.

Let us suppose that a general pool was established and the merchant ("purchaser") was made to surrender the eggs he acquires from producers and natives to the pool. He would then become a participant in the pool and would share in the pool pay-out. At the same time he needs eggs to supply to his customers and would have to buy his requirements from the pool. In respect of this purchase he would be charged the selling price asked by the pool, say, 1/6 per dozen, and in respect of his participation in the pool he would be entitled to the pool pay-out, say, 1/3 per dozen. The amount due to him would be set off against the amount he owes and he would remit to the Board the difference of threepence.

In the draft Bill a short cut to this position is taken, it being simply provided that a contribution calculated by the Marketing Board in the manner described shall be paid to the Board.

The description of this system may sound complicated, but the operation of the system itself will, in fact, be otherwise. It resolves itself into a simple return once a month from producers and certain purchasers and, in the Board's office, a cross check of returns and a little simple bookkeeping.

Fixed Levies from Merchants.—There is one important objection to this means of levy assessment which required to be removed. It leaves the merchant who buys from a producer in ignorance of the amount of the levy he will have to pay to the Board until he receives a debit note on the closing of the monthly or period pool. He will therefore not know his total cost price and so will have difficulty in fixing his selling price. The point is met in the Bill by a provision

that the merchant may, if he chooses, require the Board to quote him a definite figure before the beginning of each month. (Section 8 (3)). If at the close of the pool the figure quoted him should prove to be higher than the contribution calculated as provided in the Bill, he will be entitled to a credit, that is to say the excess will be refunded to him. If it should prove to be lower, the pool will bear the loss.

Reasons for Method Proposed.—It may be asked why a variable contribution to the pool assessed as proposed in the Bill is preferable to a fixed levy. The reasons are exceedingly important, but they can only be shortly indicated here:—

(a) The method establishes the effect of a general pool without the costs and losses attendant on physical handling. By this means it avoids an arbitrarily fixed levy on merchants, etc., which may be more or may be less than is actually necessary to the object of market regulations, namely, an equitable price to the producer.

(b) It will not be desirable to collect the same levy from all districts irrespective of geographical and other difficulties and circumstances. By assessing the levy on the basis of the Board's selling price in the relative place and circumstances it is made possible to reduce or eliminate the levy when desirable.

(c) Consideration will show that the system will encourage the merchant who buys from a producer to pay him a price equivalent to the payment he would obtain from the pool in the relative circumstances. The producer would otherwise consign to the pool and thereby dislocate the trade in his area.

(d) It is desirable that the merchant be induced to maintain his selling prices in a certain conformity or relation to the pool's wholesale selling price. These prices being variable, it will probably be necessary to influence his cost price in a variable degree.

(e) Seasonable variation of supplies may necessitate a comparatively large levy in certain months and a small one in winter. The amount necessary is logically reflected or established by the difference between the pool pay-out and the pool selling price.

There are obviously several reasons for this, but one is enough to exemplify the point. In the flush season the pool may have to export and the amount of the levy will be such as will spread the burden of export fairly. In winter no export will probably be necessary and the levy may then be much lower.

Exemption from Levy.—It has been said that under the system proposed the levy could be reduced or eliminated altogether where geographical or other circumstances justify. This should prevent hardship, and from the poultry farmers' point of view it is desirable, because it would be wrong to establish a standard of returns to producers in outlying districts which would encourage uneconomic production. Eggs will not stand long road transport.

BILL

To provide for the compulsory control of the marketing
of eggs.

BE IT ENACTED by the King's Most Excellent Majesty,
by and with the advice and consent of the Legislature of the
Colony of Southern Rhodesia, as follows:—

Short Title and Date of coming into Operation.

1. This Act may be cited for all purposes as the "Egg Marketing Act, 19..." and shall not come into operation unless and until the Governor has declared by Proclamation in the *Gazette* that it is His Majesty's pleasure not to disallow the same. Thereafter it shall come into operation on such date as the Governor shall by the same or like Proclamation declare.

Interpretation of Terms.

2. In this Act, unless inconsistent with the context—

"egg" means the egg of the domesticated fowl;

"Minister" means the Minister of Agriculture and
Lands;

“native” means any member of the aboriginal tribes or races of Africa, or any person having the blood of such tribes or races and living among them and after the manner thereof;

“prescribed” means prescribed by regulation made under this Act;

“producer” means any person other than a native who himself or by means of his agents or servants produces and sells or otherwise alienates eggs or who imports eggs for the purposes of incubation;

“purchaser” means any person who purchases or otherwise acquires eggs from any producer or native or who imports eggs for any purpose other than incubation.

Establishment of Egg Marketing Board.

3. As from a date to be fixed by Proclamation in the *Gazette*, there shall be established a Board to be known as the Egg Marketing Board (hereinafter referred to as the Board), which shall be a body corporate capable of suing and being sued in its corporate name, and, subject to the provisions of this Act, of performing all such acts as bodies corporate may by law perform.

Constitution of Board.

4. (1) The Board shall be appointed by the Governor and shall consist of a Government official, a member of the Bulawayo Chamber of Commerce, a member of the Salisbury Chamber of Commerce and two producers.

(2) The members of the Board shall hold office for a period of two years; on the expiry of his period of office, a member of the Board shall be eligible for reappointment.

(3) Any casual vacancy on the Board shall be filled by a nominee of the Minister.

(4) The Board may appoint from its own members an executive committee, not exceeding three in number, one of whom shall be the chairman of the Board and one a producer.

(5) The Government official shall be chairman of the Board and of the executive committee and shall have a casting vote only.

(6) The Minister may appoint any member of the Board to act as chairman whenever through illness, absence or other cause it may be necessary to do so, and the member so appointed to act shall during the term of his appointment be chairman of the executive committee and otherwise exercise and fulfil all the powers and duties of the chairman of the Board.

(7) The chairman and members of the Board shall be paid out of the funds of the Board such remuneration or allowances as the Minister, with the advice of the Board, may from time to time determine.

Power of Land Bank to make Loans to Board.

5. Notwithstanding anything contained in the "Land Bank Act, 1924," as amended from time to time, or any other law, it shall be lawful for the Land and Agricultural Bank of Southern Rhodesia to make loans to the Board.

Producers must surrender to Board eggs not otherwise disposed of.

6. (1) Except as provided in sub-section (3) of this section, a producer shall surrender to the Board at such time and place as the Board may direct all eggs which he produces and which he does not alienate to a purchaser nor retain himself either for consumption in his own household or for incubation.

(2) Eggs surrendered to the Board shall on the issue of a receipt by the Board be vested in and become the property of the Board, but the risk and profit in them shall not pass to the Board until the issue of the Board's receipt.

(3) Eggs, which the Board has refused to accept in terms of paragraph (c) of section twelve of this Act, shall not be surrenderable to the Board.

Monthly returns to be submitted by all producers and by certain purchasers.

7. (1) Every producer shall, not later than the seventh day of every month, render to the Board a return showing the

number of eggs alienated by him to any purchaser during the preceding month and such other particulars as may be prescribed.

(2) Every purchaser, who belongs to such class or classes as may be prescribed, shall, not later than the seventh day of every month, render to the Board a return showing the number of eggs purchased or imported or otherwise acquired by him during the preceding month and such other particulars as may be prescribed.

Contributions to be paid by certain purchasers.

8. (1) Every purchaser, who belongs to such class or classes as may be prescribed, shall pay to the Board on all eggs which he purchases or imports or otherwise acquires from producers or natives a contribution assessed in accordance with the provisions of this section.

(2) The Board shall debit the purchaser with the price which the Board would have charged him had he bought from it the eggs which he so imported or acquired, and shall credit him with the distribution to which he would have been entitled had he been a participant in the Board's appropriate pool or pools in respect of such eggs. The excess of the debit over the credit shall represent the contribution due by such purchaser and shall on notification from the Board immediately become payable by him to the Board.

(3) Instead of paying the contribution as in the last preceding sub-section provided, the purchaser may before the beginning of each month contract with the Board to pay an agreed contribution per dozen on all eggs imported or acquired by him during the succeeding month. If on the closing of the accounts of the relative pool period such purchaser has paid more under such contract than he would have been liable to pay as a contribution in terms of the preceding sub-section, the Board shall refund him the excess.

Contributions to be paid by certain producers.

9. (1) Every producer, who belongs to such class or classes as may be prescribed, shall pay to the Board on all eggs which

he alienates to any purchaser to whom the provisions of section *eight* do not apply a contribution assessed in accordance with the provisions of this section.

(2) The Board shall debit the producer with the price which the Board would have charged him had he bought from it the eggs which he so alienated, and shall credit him with the distribution to which he would have been entitled had he been a participant in the Board's appropriate pool or pools in respect of such eggs. The excess of the debit over the credit shall represent the contribution due by such producer and shall on notification from the Board immediately become payable by him to the Board.

Contributions to be credited to Pools.

10. The Board shall credit to the pool or pools operated by it in such proportion as it may determine all moneys paid by purchasers and producers under the provisions of sections *eight* and *nine*.

Power of Board to reduce or waive contributions.

11. The Board may in its discretion reduce or waive entirely the contribution due from any purchaser or producer in terms of this Act when by reason of the geographical position of such purchaser or producer or for any other reason whatever such action seems to it desirable.

Powers of Board.

12. (1) The Board shall have the power—

- (a) to deal with the eggs surrendered or accounted for in one pool or several pools which shall be operated on such basis and in such manner as it may determine from time to time;
- (b) to charge its administrative and other costs and disbursements to the pools operated in such proportion as it may determine;
- (c) to transfer at its own valuation stocks which are unsold at the closing of the pool to the similar pool or pools of the succeeding pool period;

- (d) to deal with any of the eggs surrendered or accounted for to it without pooling them;
- (e) at its discretion to grant advances to and to make disbursements on account of any producer or importer who has surrendered eggs to it and to differentiate in its advances, distributions or other payments to or on account of such producer or importer on account either of quality or of the geographical area in which such eggs were produced, or of the situation of the place and the date or period at which such eggs were delivered to it;
- (f) to deduct from any pool distribution or other payment due to a purchaser any advances or payments made to or on behalf of a producer in terms of the preceding paragraphs;
- (g) to dispose of any eggs vested in it in any manner or on any terms it may deem best, and for this purpose to enter into contracts for sale, and to accept, in respect of such contracts, promissory notes, bills and other instruments of commerce or exchange;
- (h) to purchase eggs and to allocate the profits and losses on such transactions between its pool accounts in such manner as it deems best;
- (i) to import eggs, and to purchase and sell eggs outside the Colony for the purpose of maintaining and developing markets and to allocate the profits and losses on such transactions in its pool accounts in such manner as it may determine;
- (j) to appoint and employ such persons as it may deem requisite, and to fix the terms and conditions of their appointments;
- (k) to pay to any person in its employ remuneration according to the conditions of his appointment;
- (l) to enter into contracts for carrying out any work in connection with the handling, treatment,

transport, storage, grading, sale or export of its eggs or egg products, or any other matter connected with its operations;

- (m) to borrow money to enable it to carry out the functions aforesaid;
- (n) to pledge as security for any loan any eggs vested in it and to give any other security which may be available to it;
- (o) to decline to accept any eggs which it considers to be unsuitable for sale or which, because of quality, transporting facilities or any other reason, it may deem undesirable to accept;
- (p) to make rules relating to the receipt, handling, grading, treatment, transport, storage and despatch of eggs by producers and by its local agents;
- (q) to make interim distributions to producers of the proceeds of any sale or sales of eggs after deducting therefrom the amount of any advances or disbursements made to or on behalf of such producers and the estimated cost of administration, provision for bad debts or other costs or losses incurred;
- (r) in the case of the death or insolvency of any producer or other participant in a pool, to make such final payment to the deceased or insolvent estate before the final closing of the pool as it may consider equitable and is agreed to by the executor or trustee;
- (s) to require any transport agent to furnish such returns or duplicate consignment notes or such information as it may require in respect of eggs transported by him which were not consigned by or to it;
- (t) to require any person to furnish in such manner and such form as it may request such information as to his transactions in eggs and the eggs in his possession or under his control;

- (u) to enter into agreements with any egg-selling organisation in any adjacent territory when it considers that such an agreement would be advantageous;
- (v) to do all such things as in the opinion of the Minister may be necessary for performing its functions under this Act.

(2) In the exercise of its powers under this section, the Board shall be subject to the approval and direction of the Minister, but the Minister may grant to the Board such general authority to act without reference to him as he may think fit.

Offences.

13. (1) If any person—

- (a) contravenes or fails to comply with any provision of this Act; or
- (b) being a purchaser or a producer fails to render true returns as required by this Act or prescribed by this regulation or to pay contributions for which he is liable under this Act;
- (c) fails to render any information required from him in terms of this Act, or in any such information knowingly makes a false statement;

he shall be guilty of an offence and liable for a first conviction to a fine not exceeding one hundred pounds, or, in default of payment, to imprisonment with or without hard labour for a period not exceeding twelve months, and for a second or subsequent conviction, to a fine not exceeding two hundred pounds, or, in default of payment, to imprisonment with or without hard labour for a period not exceeding two years.

(2) In addition to any penalty which it may inflict, the court convicting an offender may, upon application by the prosecutor, give summary judgment, for the amount of any contribution due and unpaid by him in terms of this Act, and

such judgment shall have the same force and effect and be executed in the same manner as if it had been given in a civil action duly instituted by the Board before such court.

Regulations.

14. The Governor may make regulations not inconsistent with this Act, providing for—

- (a) the procedure and conduct of the meetings of the Board and of the executive committee;
- (b) the keeping of the books and other records of the Board, and the auditing thereof;
- (c) the forms of any documents required for giving effect to the Act or any regulation;
- (d) the conditions under which the chairman and members of the Board shall hold office, the granting of leave to members of the Board and the appointment of a substitute to hold office during the absence of a member on leave;
- (e) the submission of returns by such producers, purchasers, importers and other persons as may be determined in such forms as may be prescribed;
- (f) the classification of eggs accepted by the Board;
- (g) the registration by the Board of such producers, purchasers and importers as may be determined;
- (h) the prohibition, regulation or control of the importation into and export from the Colony of eggs or egg products; and
- (i) generally for carrying out the purposes of the Act.

Freedom of Board from certain Liabilities.

15. No liability shall attach to the Board or to any member thereof for any loss or damage sustained by any person as a result of the *bona fide* exercise or performance by the Board, or a committee thereof or by any servant or agent of the Board, of any power or duty conferred or imposed upon the Board by this Act.

Powers to enter on land and examine stocks and accounts.

16. At all reasonable times any European member of the police, or any person generally or specifically authorised by the Minister, may enter upon the premises of or any land or place occupied by any producer, purchaser or any other person, and may examine all stocks of eggs and egg products and all books, accounts and documents relating thereto, and require an explanation of any entries or documents referring or suspected to refer to transactions in eggs or egg products, and may seize any such books, accounts or documents as may afford evidence of contravention of the Act or of any disregard of the terms of any notice issued under the Act.

How to use an Engineer's or Farm Level.

By P. H. HAVILAND, B.Sc. (Eng.), A.M.I.C.E.,
Irrigation Engineer (Matabeleland).

The level is an instrument which may be used on numerous occasions in farming operations, and as small farm levels and second-hand engineers' levels can be purchased comparatively cheaply, an explanation of the method of use may not be out of place.

To Find the Difference in Level between Two Points.

Setting up in Suitable Position.

The level being in adjustment, set it up at a convenient place from which each point can be seen; if possible, half-way between the two points whose difference in level is to be found, as this reduces errors.

Levelling up the Engineer's Level Ready for Use.

Level up the telescope over two footscrews. Turn it through 90 degrees and level up over the third footscrew, or in the case of a fourscrew instrument, over the two remaining footscrews. Turn the instrument through a further 90 degrees in the same direction, and if the bubble is in the centre the instrument is ready for use. If not, correct half the error by means of the footscrews and then bring the bubble to its centre position by means of the small adjusting nuts.

Turn again through 90 degrees, so that the telescope now lies over the third footscrew as before, and again adjust by this footscrew if necessary.

When the bubble remains in the centre of its run for all positions, the telescope is levelled up correctly.

Levelling the "Farm" Level Ready for Use.

As a rule this type has only one levelling screw. The bubble is brought to the centre of its run for each reading.

To Obtain the Difference in Levels.

The level staff graduated in feet and tenths of a foot or in feet and inches is held on the back point in a vertical position, and the reading noted as a back sight (afterwards referred to as B.S.). Now turn the telescope to point to the forward point and read the staff held there. This is noted as a foresight (afterwards referred to as F.S.). After each reading the bubble should be examined to see that it is still in the centre of its run.

The level of the first point being known or assumed, this is entered opposite the station number in the column marked "Reduced Level" (referred to as R.L.; see specimen page of level book).

The B.S. to the point is entered in the B.S. column opposite its station number, and the F.S. is entered in the F.S. column opposite its particular station number. To obtain the "height of instrument" (H.I.), add the B.S. to the R.L. of the station and enter in the column marked H.I.

To obtain the R.L. of the forward station, subtract the F.S. to this station from the H.I. level, and note in the R.L. column opposite the station number.

Running a Line of Levels.

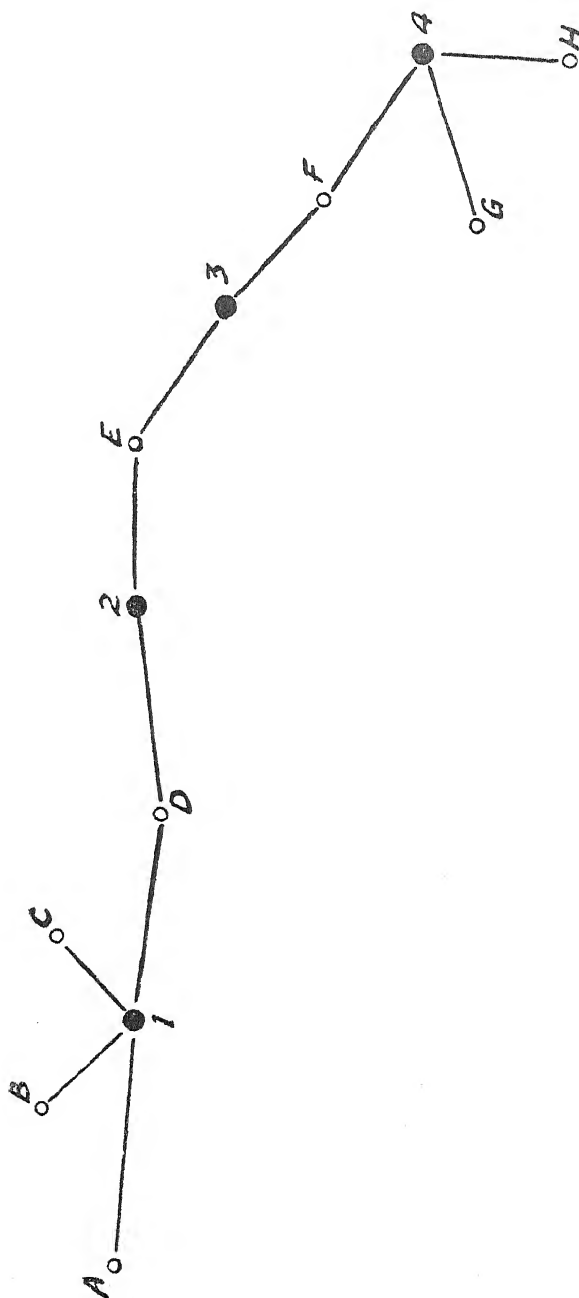
That is, obtaining the levels of a number of points which are not all visible from one "set up."

The readings to more than one point may be read from a single "set up" of the instrument with one B.S. to a peg whose level is known.

The staff readings to these other points are then entered in the intermediate sight (I.S.) column, with the exception of the sight to the station from which the line of levels is to be carried on. This reading is entered in the F.S. column.

Intermediate sights are treated as foresights to obtain the level of the point at which the intermediate sight is read, and

FIG. I.



Points A, B, C and D are visible from 1.
 Points D and E are visible from 2.
 Points E and F are visible from 3.
 Points F, G and H are visible from 4.

the reduced levels of such points are obtained by subtracting from the H.I. for the particular "set up."

Fig. I. shows a plan of a series of points whose levels are to be found. The numbers indicate the points at which the instrument is set up.

SPECIMEN PAGE OF LEVEL BOOK FOR LEVELS OF POINTS A TO H.

Station Number.	B.S.	I.S.	F.S.	H.I.	R.L.	Remarks
A	4.35			119.74	115.39	
B		6.29			113.45	
C		3.14			116.60	
D	0.35		5.07	115.02	114.67	
E	7.81		3.86	118.97	111.16	
F	3.88		2.48	120.37	116.49	
G		6.80			113.57	
H			5.76		114.61	

Check.

To check, add up the B.S. column and add up the F.S. column and subtract one from the other. This result must be equal to the difference between the R.L.'s of the first and last points.

sum of F.S. column=	17.17	R.L. point A=	115.39
„ B.S. „ =	16.39	„ „ H=	114.61
	<hr/>		<hr/>
	.78		.78

Explanation.

(a) The instrument is set up at 1; B.S. to A is read=4.35 and noted as shown; the R.L. of A is assumed 115.39 and is noted as shown. B.S. added to R.L.=H.I.=(4.35+115.39)=119.74. The H.I. is noted opposite the station number of the station to which the B.S. is read.

The staff is then held and read at B=6.29, the reading noted in I.S. column and subtracted from H.I. giving R.L. of B as 113.45.

The R.L. of C is obtained similarly by reading the staff at C (=3.14).

Staff is then read at D, the reading being 5.07. This is now entered in the F.S. column, and the R.L. of D is obtained by subtracting 5.07 from 119.74, giving 114.67.

(b) Leaving the staff at D, the instrument is now moved and set up at 2. B.S. to D, which is 0.35, is noted in column. The H.I. is obtained thus: $(0.35 + 114.67) = 115.02$. The staff is then held at E and the reading is 3.86, which is a F.S.

Subtract this from 115.02, giving the R.I. of E as 111.16.

(c) Leaving the staff at E, set up at 3 and obtain the R.I. of F as before.

(d) Leaving the staff at F, set up at 4. The R.L.'s of G and H are then found as explained previously.

The levels may then be continued as from H, or new lines of levels may be run from any of the other points whose levels are known.

Domestic Water Supplies and Sanitation on the Farm.

By P. H. HAVILAND, B.Sc. (Eng.), A.M.I.C.E.,
Irrigation Engineer (Matabeleland).

A safe and efficient domestic water supply is a necessity everywhere, and in consequence its planning cannot be given too much consideration. In towns and large villages the individual consumer of water is not required to investigate his own water supply problem, but unfortunately the farmer is not in such an enviable position. It is, therefore, with the object of enabling him to instal the most satisfactory domestic water scheme possible that this article has been written. It must not, however, be considered that this is a complete treatise on the subject, and the farmer would still be advised to obtain the advice of the engineer, the chemist and the bacteriologist.

Purity of Supply.—It is an absolute necessity that the purity of the water consumed for domestic purposes should be beyond doubt, and steps must always be taken to ensure this. These remarks apply not only to the water consumed by human beings, but equally to that consumed by live stock. Water is never obtained naturally in a state of absolute purity, and always contains mineral and organic impurities to a greater or lesser extent.

Mineral impurities in Rhodesian waters, on account of the small quantities present, as a rule have no harmful effects, and only produce varying degrees of hardness.

The organic impurities which may be present are of two kinds, animal and vegetable. The latter, resulting from the actual growth of vegetation in the water, and from sticks and leaves falling into the water, are not dangerous in themselves unless present in large quantities, but they may form the food for toxic bacteria, and so should be guarded against.

Animal impurities are very dangerous, and it is therefore necessary to take every precaution to reduce the possibility of animal pollution occurring. The pollution of any water supply can take place extremely easily, and contamination is not always noticeable immediately. Polluted water containing germs which are harmful may lead to the outbreak of diseases such as typhoid and dysentery in the cases of human beings or in the case of live stock many parasitic diseases.

It must be realised that the danger of pollution is ever present in water, no matter from what source it may be obtained, although it is less likely to occur in deep-seated borehole supplies than in surface or shallow well waters. The latter must always be considered as highly potentially dangerous. Water stored in tanks and reservoirs very frequently suffers contamination due to the presence of dead animals, insects, etc.

Water in which any pronounced odour or taste is noticeable must always be suspected. Good potable water should be clear, colourless and without odour, and neither too acid nor too alkaline or brak; but the water, in spite of possessing these physical characteristics, may still be unfit for consumption, and consequently bacteriological and chemical analyses are very strongly recommended in every case.* For chemical analysis at least half a gallon of water is required.

All drinking water which has not been purified by some more efficient method should be boiled for a period of 15 minutes. Merely bringing the temperature of water up to boiling point and not maintaining it at that temperature for any length of time is useless as a means of purification.

The primary source of all water is rain, and water supplies may be obtained directly from this source by collection from surfaces, such as roofs, or indirectly as ground surface water or as underground water. Surface waters exist as streams, rivers and wet vleis, and underground waters as those obtained from wells, boreholes, etc. Each of these sources yields a water possessing different characteristics.

*Chemical analyses are made by the Agricultural Chemist, Department of Agriculture, free of charge. Bacteriological analyses are made by the Public Health Laboratory, for which a fee is charged.

Rain Water.—This as a rule is considered comparatively safe for domestic consumption if collected from a clean surface. The taste is somewhat insipid. It is practically free from any chance of animal faecal pollution, except when it is stored underground, but it is almost invariably contaminated by the “droppings” of birds and by dead insects. Its physical appearance is usually somewhat against it, as a large quantity of dust is collected not only in its passage over the collecting material but also in its passage through the air.

Where rain water is collected from the roofs, a thorough cleaning of all gutterings, down-spoutings and storage tanks should be carried out immediately the rains commence.

Well Water.—Shallow wells form a very dangerous source of supply owing to the many opportunities of suffering pollution, and they should always be considered as probably contaminated. Such water, in spite of being bright, clear, sparkling and pleasant to taste, may nevertheless be polluted. Great care should be exercised in the selection of a site in relation to existing or proposed drains, privies, cesspools, etc. In this selection regard must also be had to the type of soil, contour of the land surface and geological formations. An apparently safe well may become polluted by the reversal of the direction of drainage movement owing to drought or heavy pumping, and it is only when the water in the well is higher *all the time* than any possible source of pollution that a well is really safe.

Figure I. shows how the direction of underground drainage movement may be reversed. A—A is the natural water table at the time the well was sunk, the arrows showing the direction of the drainage movement. B—B is the water table after pumping, and a partial reversal of direction is shown at D. Further pumping or drought may lower the water table to C—C, and a complete reversal of drainage movement occurs. When the water table is at A—A the supply of water in well number I. is safe. When the table is lowered to B—B danger of pollution from the privy as shown occurs, and when it is further lowered to C—C danger of pollution from the sewage pit is present. Well number II. is always unsafe, unless complete reversal of drainage movement occurs.

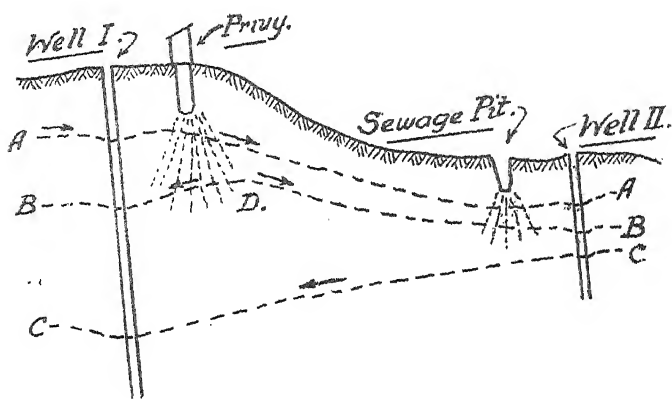
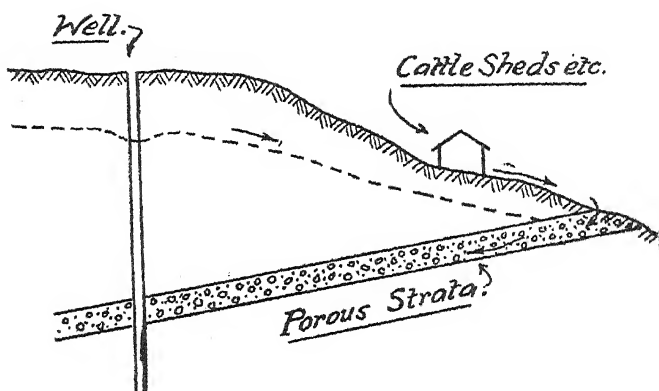
Fig. I.Fig. II.

Figure II. shows how an apparently safe well may become polluted owing to the presence of strata of porous material, even when the water table stands higher than the source of pollution. Storm water passing down the slope carries with it polluting matter and this seeps into the porous material and passes down to the well as shown by the arrows.

Another way in which pollution can take place is by storm water entering the mouth of the well. This must be guarded against by building a suitable well coping or curbing. The lining of the well must be carried above the ground level, and the coping should be placed in close contact with it. This coping is best constructed of concrete or masonry. All wells should be covered in at the top, and if a fixed cover is placed, a manhole, with suitable means of closing it, must be left in the cover. A drawing of one type of well coping and cover is given, and the following are the quantities of material required for a cover for a well of five feet diameter:—

QUANTITIES FOR WELL COVER (REINFORCED CONCRETE).

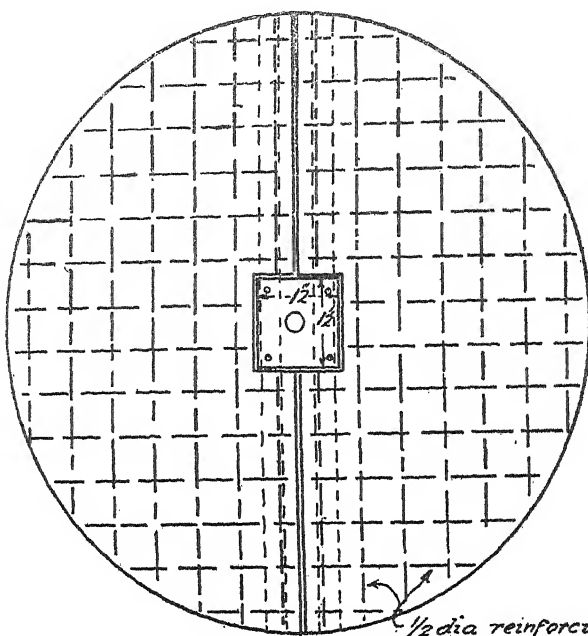
Cement	1½ bags
Sand	5 cubic feet
Stone	10 cubic feet
M.S. Bars, ½-inch diameter ...	150 feet
Baling wire	100 feet

The coping is shown as masonry, and the cover of reinforced concrete. The latter is cast in two halves. No manhole is necessary, the halves being drawn apart to enable the well to be entered.

All wells should be protected by surface drains on the higher side to prevent the approach of any storm water within 25 feet of the well.

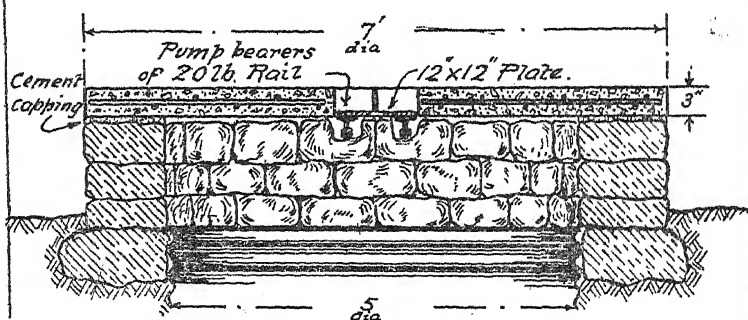
Well water as a rule is hard, the hardness generally being "temporary" and removable by boiling.

Borehole Water.—In general characteristics this is similar to the well water described above. The possibility of pollution is slight, and the water is usually of a good potable nature. Boreholes in certain localities in this country have been found to yield water which is highly mineralised, but



$\frac{1}{2}$ dia reinforcing
bars to be tied at all
intersections.

PLAN.



SECTION.

WELL COVER.

(REINFORCED CONCRETE.)

Scale 0 1 2 3 4 Feet.

B.G.G.
12/1/50

as a rule this is harmless. Usually sufficient protection against contamination is afforded by the borehole casing being carried down to solid formation and left standing above the surface of the ground about a foot.

Springs.—Spring water generally is safe, but if there is any doubt, a sample should be submitted to the bacteriologist for analysis. The protection of springs is important, particularly when water is stored at the spring itself. Springs should be built in and covered up. Fencing should also be placed to prevent the approach of cattle. It is not usually a sound policy to endeavour to open up a spring, as frequent tampering with the “eye” may cause a disappearance of the water.

River Water.—This is highly dangerous, as it is an impossibility to prevent pollution occurring. Rivers are always open to contamination by disease carriers, and the water should never be drunk without disinfecting or boiling. Should a river form the source of domestic water supply, fencing round the portion of the river above the intake works must be resorted to, and cattle should be kept off as much of the catchment area as possible.

General.—That disease has never occurred after drinking water obtained from any particular source is no criterion that the source is unpolluted. It is possible that the high degree of immunity acquired by the individuals concerned may have prevented an outbreak from occurring. But if a breakdown of immunity occurs and any one person becomes infected, the contagion may spread rapidly.

Quantity of Water Consumed.—The actual quantity of water consumed per head per diem varies considerably in every locality, and also varies with the season of the year. In summer, the quantity consumed will, of course, be greater than in winter. For the purpose of deciding on small water supply schemes, it will be sufficient to assume average figures, and from these the total quantity of water required at any one establishment per diem may be found. The following figures may be used as a basis:—

Europeans—25 to 35 gallons per head per diem.
Natives—5 to 10 gallons per head per diem.
Working Oxen—15 gallons per head per diem.
Milk Cows—15 gallons per head per diem.
Horses and Mules—10 gallons per head per diem.
Pigs—4 gallons per head per diem.

The figures for consumption of water by Europeans include water for a sewerage system, but not for garden purposes. It is noticeable that the greater the quantity of water available the greater is the quantity consumed. From the hygienic point of view the greater the amount of water consumed the better are health conditions.

Utilising the above figures, the water requirements for 5 Europeans and 30 natives would be 475 gallons per diem.

General Investigations.—Having arrived at the quantity of water required, the next factor to be considered is the most suitable source of supply. The various sources, together with the characteristics of the water obtainable from each, have already been discussed. In deciding on the source, safety from pollution is a point which must not be lost sight of, and where two schemes are possible at approximately similar capital outlay, that source where the least danger from pollution exists will naturally be decided upon. Another factor to be considered is the permanency of the supply. For instance, a shallow well, the yield of which has not been thoroughly tested, can never be considered as having a permanent supply. Where a new settler takes up land, he should first assure himself as to the permanency of water before spending any money on a scheme.

The capital outlay required to instal any particular water supply scheme must also be investigated, and in this respect running and maintenance costs must be entered into. A scheme which is somewhat expensive in first cost may prove cheaper in the long run than one entailing a lower initial outlay with greater running expenses.

As a general rule a gravitation scheme is the most economical, except where a very high initial outlay is required, but unfortunately the conditions necessary very seldom exist on the farms in this country. Where pumping

has to be resorted to, wind or water engines will be found the cheapest. These will be discussed later, together with other prime movers.

In investigating the quantity of water available from any source, different methods of measurement are employed. These methods will now be described. The most suitable period of the year for testing the quantity of water available is August to November, as stream flow at that time is usually at its lowest.

Yield of Wells.—The actual quantity of water flowing into a well may be found by a continuous baling or pumping test extending over a period. The longer the duration of the test the more reliable will be the results obtained, and no test should be of less duration than 24 hours. The following information is required:—*

1. Depth of water in well at commencement of test in feet (h_1).
2. Depth of water in well at end of test in feet (h_2).
3. Duration of test in hours (t).
4. Average diameter of well between depths h_1 and h_2 in feet (d).
5. Total quantity of water baled or pumped out during the test in gallons (q).

The total quantity of water in gallons which has flowed into the well during the test is obtained by multiplying the distance the water has been lowered in feet by the value of x , which applies to the particular average diameter, and subtracting this result from the total quantity of water which was removed from the well during the test.

By dividing this final result by the duration of the test in hours, the rate of inflow of water into the well in gallons per hour is obtained. This rate of inflow may be stated as—

$$\frac{q - x(h_1 - h_2)}{t}$$

*If this information is submitted to the Irrigation Division, Department of Agriculture, Salisbury, yields of wells can be checked and the farmer notified of the result.

The values of x applicable to any case are given in the following table:—

Average diameter of well (d).	Value of x .
3 ft. 6 in.	60
4 ft.	78
4 ft. 6 in.	99
5 ft.	122
5 ft. 6 in.	148
6 ft.	176

For average diameters which lie between those given in the table, a suitable value of x may be estimated.

Gauging of Streams.—Should the stream be small, the quantity of water flowing may be obtained by turning the whole stream into a vessel, such as a petrol tin, whose capacity is known, and finding out how long it takes to fill, and from this the quantity in gallons per hour can be obtained.

Suppose it takes 3 seconds to fill a petrol tin of 4-gallons capacity, the yield will be $\frac{60}{3} \times 4$ gallons = 80 gallons in a minute, or 4,800 gallons per hour.

Should the stream be too large to gauge in this manner, the most suitable way will probably be by means of a rectangular notch. This method is illustrated in Figure III. A rectangular notch or opening is constructed out of metal or wood, the width of the notch being not less than three times the depth of water flowing over it. The notch is set across the stream, and a temporary dam constructed on each side of it in order to raise the water behind and cause it to flow through the notch. A peg is then set in the stream about 5 feet above the notch, the top of the peg being set level with the sill of the notch. The sill of the notch must be placed sufficiently high to allow air to pass underneath the apron of water which flows over the sill. Then, the width of the opening being known, the quantity of water can be obtained by measuring the depth of water above the top of the peg. The width of the sill is marked "w" in Figure III., and the depth of water above top of peg is "h." The attached table gives discharges for various values of "h" for each foot-width of sill:—

Note: The height of water " h " must not exceed $\frac{1}{3}$ the width of notch " w ".

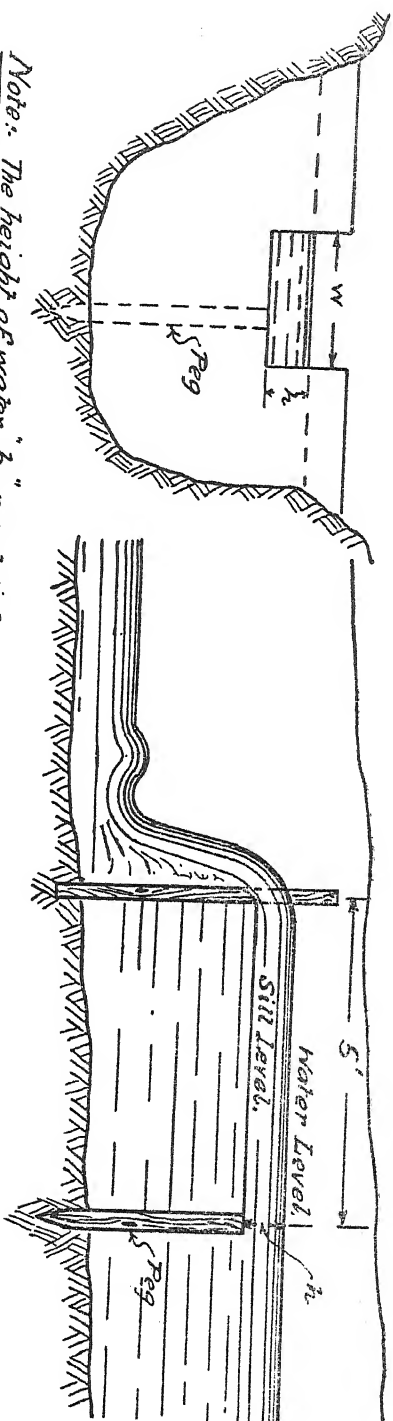


Fig. III.

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12/11/14

TABLE.

Discharge in gallons per minute from each foot of width of sill.

Depth of water above top of peg in inches (h).	Fractions of an inch.			
	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
0	0	3.7	10	19
1	30	40	55	69
2	84	100	118	135
3	155	175	195	216
4	239	261	284	309
5	334	359	384	409
6	434	463	493	523
7	552	583	613	644
8	675	706	736	768
9	806	837	867	906

Another method is by measuring the cross-sectional area of the water flowing in a stream and determining its velocity. A part of the stream which has a fairly regular section and a smooth flow should be chosen, and the area determined by measuring the average depth and width in feet. These two multiplied together give the approximate average cross-sectional area. To determine the velocity measure off a distance along the bank and float corks down the centre of the stream, and take the time occupied in travelling the measured distance. From this the velocity is found in feet per second. The true velocity is then two-thirds of this surface velocity.

By multiplying the cross-sectional area in square feet by the true velocity in feet per second and then multiplying this result by $6\frac{1}{4}$ the flow of the stream in gallons per second is found.

When the possible sources of supply have been tested to determine the actual quantities of water available, it will then be necessary to investigate the difference in level between such sources and the point at which the water will be consumed. Should the source be higher than the point of consumption, a gravitation scheme will serve, but if the source is lower, pumping or a combination of pumping and gravitation will have to be resorted to, as a general rule gravitation is the cheapest method, but unfortunately the opportunities for installing small schemes of this nature seldom exist.

To decide the question levels must be run, and this can be done by using a level, either of the engineer's or farmer's type. The method of running levels with such instruments is described in the article "How to Use an Engineer's or Farm Level," *Rhodesia Agricultural Journal*, and reprinted as a Departmental Bulletin. Should a farmer be without such an instrument, as is usually the case, an ordinary mason's level with sighting pieces attached will serve to determine the approximate difference in level. These sights can usually be obtained from any hardware store. A mason's level with as long a base as possible should be used, and the sights are clamped one at each end. One sight has a small opening used as the eyepiece; the other has cross hairs. The actual method of getting the difference in level between two points is similar to that used with the farm level described in the above mentioned Bulletin.

With all the data now available it will be possible to determine the most suitable scheme to instal.

Gravitation Schemes.—Water may be obtained by gravitation from streams or rivers and from springs. Should a river be the source of supply, some means of diversion is necessary, and the most suitable is a masonry or concrete weir. Particulars of the design and construction of these may be obtained on application to the Irrigation Division. Water may be carried in an open channel or in pipes, but the only advantage of the former method is its cheapness, and from every point of view it is to be condemned. It is a practical impossibility to prevent pollution occurring, no matter what steps may be taken, and an expensive system of purification would have to be installed in order to render the water safe for drinking.

Piping should always be installed in spite of the higher expense. Piping is made of various materials, but for use in small schemes in this country wrought-iron is undoubtedly the best. This may be obtained as plain or black, or else galvanised, and the latter type is the better to instal. The cost is slightly more than black piping, but its useful life is much longer on account of the galvanised covering. Galvanised wrought-iron pipes are generally jointed together by means of screw couplings or sockets.

In laying a pipe line, the ideal location would be in a straight line and on one continuous uniform grade from the inlet to the outlet. Such a location is said to be on the "hydraulic gradient," and would be that requiring the shortest length of piping with the consequent smallest friction loss (see Figure IV.). Unfortunately, this is never possible in practice, but every endeavour must always be made to adhere to the hydraulic gradient as closely as the surface of the ground will permit, and *never*, unless it is absolutely unavoidable, allow the location of the pipe line to rise above the hydraulic gradient, although it may be permitted to fall below.

The reason for not allowing the pipe line to rise above the hydraulic gradient line is that when below the pressure in the pipe is greater than atmospheric pressure, and if above it is less. If the latter condition holds, a certain quantity of the air held in the water is released, and any leakage of air possible at the joints will take place, the air being drawn into the pipe line. This air will collect at the high point in the pipe line, and even if it does not result in complete stoppage of flow will reduce the quantity of water passing through. If it is impossible to set the pipe line below the hydraulic gradient, air valves must be placed at the high points. These valves are of two types, automatic or hand operated. The former are somewhat expensive, and on small schemes the latter will usually be found quite effective. Should the pipe line rise above hydraulic grade, a height exceeding about 30 feet at sea level and less at higher altitudes, no flow will take place at all.

It is advisable to place air valves at all summits along the pipe line, even where these fall below hydraulic gradient, as there is a tendency for air to collect there, although it is not so pronounced as when summit occurs above gradient. Figure IV. shows two pipe line locations in section. Location A, B, C, D, E has a summit above hydraulic gradient, and an air valve must be placed at C. On location A, F, G, H, J, K, E air valves should be placed at G and J, although the accumulation of air at these points will not be as great as at C in the other location.

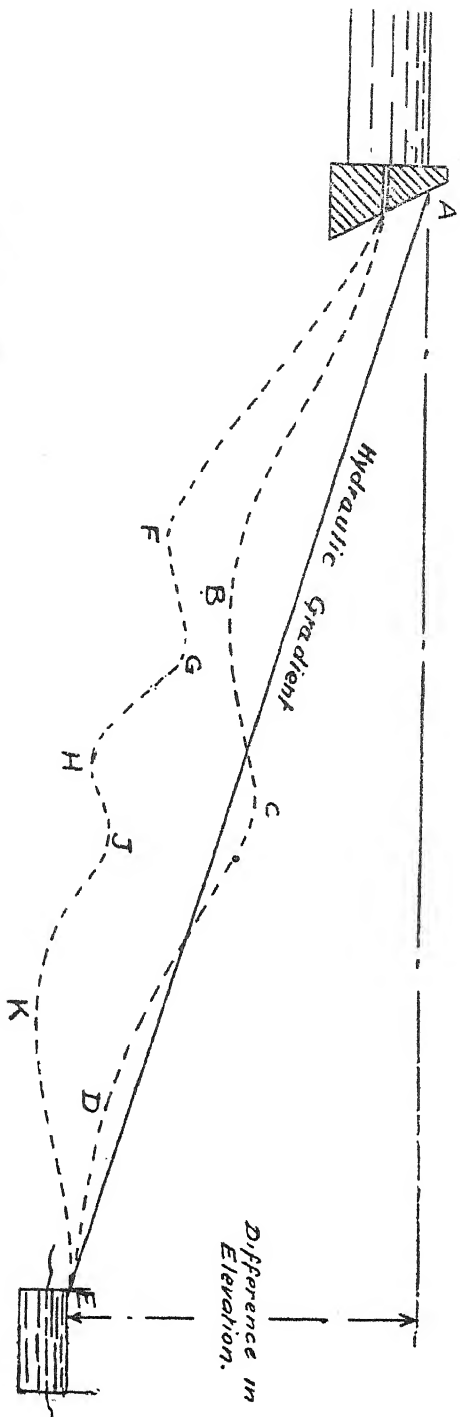


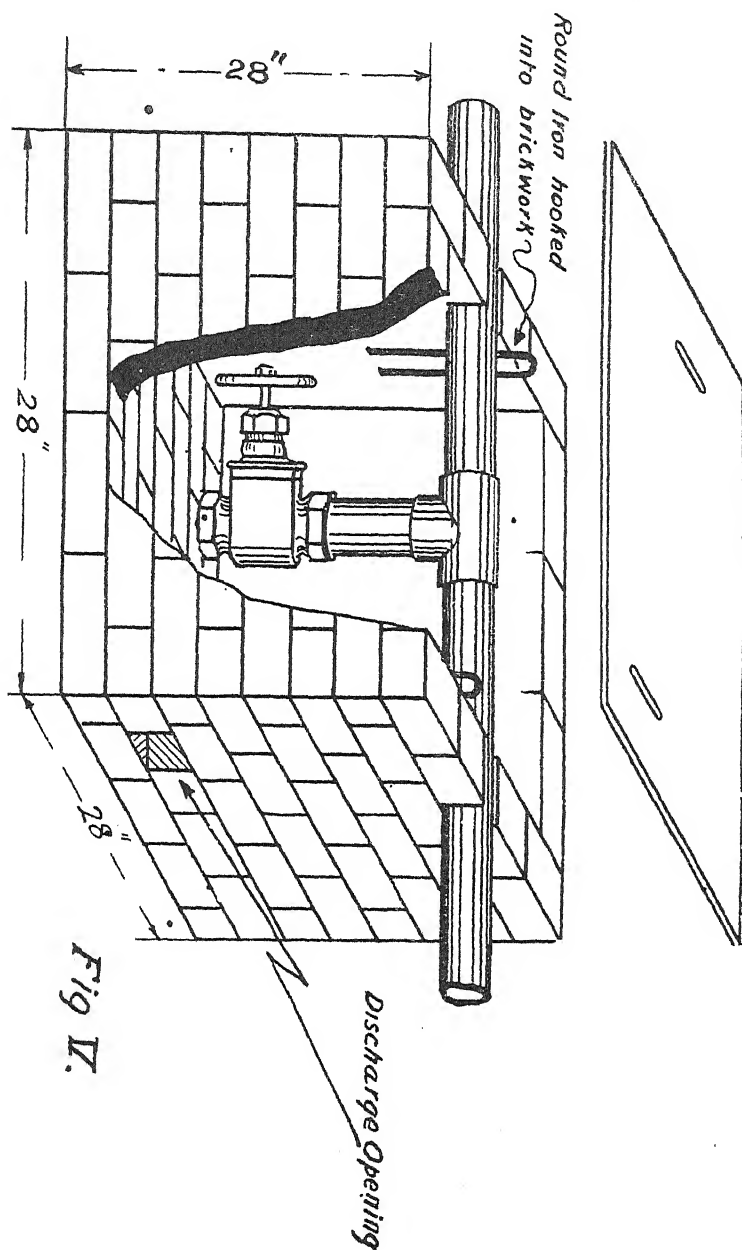
Fig. IV.

Flowing water always carries with it a certain amount of solid matter, and in a pipe line this tends to be deposited at the low points. In consequence scour valves should be placed at such positions. In Figure IV. scour valves should be placed at B and at F, H and K. A scour valve will not be necessary at D, as the pipe line beyond merely flattens out in grade and does not actually rise in elevation above D.

Scour valves may be simply constructed out of a tee piece, a short length of pipe and a full way stop valve. This arrangement is shown in Figure V. The short length of pipe serves to collect the sediment, and on opening the valve it is scoured out. Scour valves should be placed vertically below the pipe line. All valves along the pipe line should be protected by small brick in cement, masonry or concrete boxes with locked covers.

Pipe lines must, wherever possible, be laid below the ground at a depth of not less than 12 inches. In the case of pipe lines crossing cultivated lands they must be buried sufficiently deep to avoid their being fouled by ploughs or other agricultural implements. The reason for burying piping below ground level is in order to obtain as uniform a temperature as possible. Large changes in temperature cause expansion and contraction in the piping, and buckling or complete failure may result. In this country where the range of temperature is great, varying in many localities from 40 degrees to 120 degrees Fahrenheit in 12 hours, expansion and contraction is a serious matter. By setting piping underground the necessity for installing expansion joints is usually dispensed with.

On any pipe line sharp bends must be avoided. The straightest route should be adopted, and where bends must be put in the curvature must be gradual. Every curve reduces the capacity of the pipe line by causing extra friction. When filling in the trench after piping has been laid, care must be taken to see that the softer material is replaced first to avoid damage to the piping. When streams or depressions which may carry storm water have to be crossed, due protection must be given. This is best done by setting the pipe in concrete or running it through a masonry conduit. Where piping is carried above small, deep depressions, it must be well wrapped



with straw and packing. The inlet end of the pipe line should be bell-mouthed and should be enclosed in a concrete or masonry box. This box should have a vertical screen in one side of it to prevent sticks and debris from entering the pipe line. The screen may be set slightly forward, and is best constructed of copper to reduce corrosion. The screen should be of fairly coarse mesh, otherwise clogging will result very easily. After laying and before back filling the trench the whole pipe line should be tested in order that any leaking joints may be discovered. It is advisable at the same time to test all valves and fittings.

The carrying capacity of any pipe depends on the slope of the hydraulic gradient, length of pipe line and velocity of flow. The velocity of flow is intimately connected with the state of the pipe surface, whether rough or smooth, number and sharpness of bends, valves and other fittings, as all these increase the friction which is attendant on motion. As the formula used for calculating pipe discharges has in it a variable co-efficient, it will not be possible to give any simple method by which a farmer could arrive at the correct size of pipe to instal. The following table, however, gives pipe discharges which are sufficiently correct for practical purposes. Any further information required as to pipe discharges may be obtained by writing to the Chief Irrigation Engineer. The length of pipe line and difference in elevation between inlet and outlet must be given, and also either quantity of water required to be delivered or else size of pipe being installed. The grade shown in the table is the total length of the pipe line in feet divided by the difference in elevation between inlet and outlet in feet. The discharges are given for moderately old pipes. When piping is new and clean the discharge will be greater, but provision must be made for the time when the pipes become encrusted and corroded by the mineral salts carried in water. It would be unwise to instal piping which when new would carry not more than the maximum requirements.

(To be continued.)

Southern Rhodesia Veterinary Report.

JUNE, 1935.

AFRICAN COAST FEVER.

A case of Coast Fever was diagnosed on the farm Sigaro, Salisbury district, and the mortality for the month was eleven head.

Charter District.—Two cases occurred on the Greyling centre.

FOOT AND MOUTH DISEASE.

The only extension of this disease occurred on a farm within the declared infected area in the Selukwe district.

TRYPANOSOMIASIS.

Nine cases occurred in the Wankie district near the Zambesi, and five in the Melsetter district.

HORSE-SICKNESS.

Two deaths were reported from the Melsetter district.

TUBERCULIN TEST.

Eighty-six animals were tested on importation with negative results.

MALLEIN TEST.

Eleven horses were tested upon entry; no reaction.

IMPORTATIONS.

From the Union of South Africa.—Horses 10, bulls 10, cows and calves 82, heifers 1, pigs 1.

From Bechuanaland Protectorate.—Sheep 543, goats 20.

EXPORTATIONS.

To Northern Rhodesia.—Sheep 42.

EXPORTATIONS.—MISCELLANEOUS.

To the United Kingdom *via* Union ports in Cold Storage :
—Chilled beef quarters, 9,733; frozen boned beef quarters, 9,548; tongues, 23,553 lbs.; livers, 43,799 lbs.; hearts, 15,552 lbs.; tails, 6,489 lbs.; skirts, 7,130 lbs.; shanks, 29,290 lbs.; kidneys, 4,339 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 37,456 lbs.; meat meal, 56,000 lbs.; beef powder, 48,698 lbs.; beef fat, 5,000 lbs.

From Rhodesian Export & Cold Storage Company.—Beef fat, 35,268 lbs.; bacon, 2,124 lbs.

G. C. HOOPER SHARPE,

Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 32. July, 1935.

The number of swarms of the Red Locust (*Nomadacris septemfasciata* Serv.) in the Colony appears to have been augmented during June by invasion from Portuguese East Africa. All reports received have referred to the eastern half of the Colony.

The following districts are included, namely:—Darwin, Melsetter, Lomagundi, Makoni, Mazoe, Umtali, Victoria, Ndanga, Gutu, Chilimanzi and Mtoko. The swarms have varied in size from "small" to "large." In one case a swarm is reported to have taken three and a half hours to pass overhead. No particular trend of movement is indicated.

Some damage to winter wheat is reported from the eastern midland districts.

No reports of disease have been received and all specimens submitted to the headquarters office have been healthy.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

JULY, 1935.

Barometric Pressure.—Mean pressure for the month was a little above normal over the whole country.

Temperature.—Mean temperatures were about normal or a little above, although a fair amount of cool weather was experienced during the month. This was balanced by the between the 12th and 19th, and again between the 25th and 27th.

Rainfall.—Only a little drizzle and orographic rain was recorded during the month in the east and south-east of the country.

JULY 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.						Ins.	Nor- mal				No. of Days			
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.									
Angus Ranch...	...	...	85	43	74.3	48.7	61.5	60.4	56.8	51.5	69	0.08	0.15	1	...	1,500	
Belt Bridge...	972.6	...	87	38	76.9	48.5	62.7	...	58.8	52.3	64	...	...	...	...	3,700
Bindura...	897.1	...	81	39	71.4	46.3	58.9	...	56.4	50.9	70	...	...	...	...	4,426
Bulawayo ...	874.1	873.4	77	38	69.4	45.1	57.3	56.8	55.8	48.2	58	...	...	...	...	3,685
Chipinga ...	898.4	...	78	41	66.9	48.0	57.5	...	57.6	52.8	75	...	...	...	...	4,788
Enkeldoorn ...	863.1	...	78	36	67.9	43.1	55.5	56.1	54.1	48.7	69	...	0.63	0.09	1	...			
Fort Victoria ...	902.3	901.4	80	34	70.0	41.9	56.0	55.0	55.8	49.5	64	...	0.04	...	...	...
Gwaai Siding ...	910.2	...	85	31	77.5	41.2	59.4	...	52.6	46.2	61	...	...	...	...	3,571
Gwanda ...	912.9	...	79	37	72.0	46.4	59.2	...	54.9	48.1	61	...	...	...	...	3,278
Gwelo ...	867.7	...	79	33	69.5	43.6	56.6	...	53.5	47.7	66	...	...	...	...	3,229
Hartley ...	891.2	...	82	35	73.1	41.5	57.3	58.2	54.9	49.0	66	...	...	...	...	4,629
Inyanga ...	841.6	...	75	33	65.3	41.2	53.3	...	52.5	47.2	60	...	0.18	0.15	3	5,503			
Marandellas ...	842.5	...	73	37	65.5	43.2	54.4	...	52.1	47.9	72	...	...	...	...	5,453
Miami ...	884.5	...	79	39	70.3	45.1	57.7	...	58.1	51.4	64	...	...	0.10	...	4,090	
Mount Darwin ...	913.9	...	85	37	72.9	44.1	58.5	...	58.5	53.7	74	...	0.06	0.01	1	3,179			
Mount Nuza ...	803.6	...	70	35	52.7	41.2	47.0	...	45.6	42.4	80	...	2.63	...	9	6,668			
Mtoko ...	883.2	...	82	40	70.4	47.9	59.2	...	57.9	51.8	67	...	...	...	...	4,141
New Year's Gift...	...	...	86	44	73.9	48.8	61.3	...	56.5	52.1	74	...	0.30	0.24	4	2,690	
Nuanetsi ...	970.4	...	85	36	77.5	45.5	61.5	...	59.9	52.6	61	...	0.05	0.04	1	1,581			
Plumtree ...	869.6	...	78	41	69.6	47.7	58.7	...	56.9	47.8	51	...	...	0.05	...	4,549	
Que Que ...	887.7	...	82	34	73.0	43.5	58.3	...	56.0	48.8	60	...	...	0.02	...	3,999	
Rusape ...	867.7	...	78	33	67.1	41.8	55.0	...	52.0	48.9	81	...	...	0.21	...	4,648	
Salisbury ...	859.8	859.2	78	34	69.9	43.1	56.5	56.3	55.5	49.2	64	...	...	0.03	...	4,885	
Shabani ...	914.5	...	81	42	71.8	49.3	60.6	...	55.2	49.8	69	...	...	0.03	...	3,193	
Sinoia ...	894.3	...	82	32	74.3	39.1	56.7	...	55.4	49.3	65	...	...	0.03	...	3,795	
Sipitilo ...	890.9	...	80	39	71.2	46.5	58.9	...	58.5	51.3	61	...	...	0.03	...	3,876	
Stapleford...	847.3	...	72	30	58.6	36.5	47.6	...	49.0	47.5	90	...	...	0.20	...	5,504	
Umtali ...	899.4	898.4	82	40	68.8	47.6	58.2	58.4	55.9	52.7	82	...	0.24	0.28	4	3,672			
Wankie ...	933.4	...	90	43	79.4	52.1	65.8	...	58.9	49.8	52	...	...	...	...	2,990
Victoria Falls ...	918.0	...	89	37	79.5	46.1	62.8	...	57.2	50.2	61	...	...	...	...	2,567

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
- No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
- No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
- No. 634. Barley, by P. V. Samuels.
- No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
- No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
- No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
- No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
- No. 681. The Sunflower (*Helianthus Annuus*) (Revised), by S. D. Timson, M.C., Dip.Agric.
- No. 694. The Edible Canna (*Canna Edulis*), by D. E. McLoughlin.
- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip.Agric.
- No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
- No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
- No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
- No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
- No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
- No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
- No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
- No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

- No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
- No. 768. The Ground Nut (*Arachis hypogaea*), by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
- No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
- No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
- No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
- No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
- No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
- No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
- No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
- No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
- No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
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- No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist. and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
- No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.
- No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.
- No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.
- No. 901. Some Notes from the Cotton Station, Gatooma, by J. E. Peat, B.Sc. (Edin.), A.I.C.T.A. (Trinidad).
- No. 932. Further Notes from Cotton Station, Gatooma, by J. E. Peat, Empire Cotton Growing Corporation.
- No. 929. A Promising Fodder Plant, by H. C. Arnold, Manager, Salisbury Experiment Station.
- No. 936. Witchweed, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.
- No. 919. Salthush: A Winter Succulent for Sheep in Matabeleland, by D. G. Haylett, M.Sc., Ph.D., Director, Matopo School of Agriculture.

REPORTS ON CROP EXPERIMENTS.

- No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
- No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
- No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
- No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
- No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.
- No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.
- No. 895. Salisbury Agricultural Experiment Station. Annual Report, 1931-32, by H. C. Arnold, Manager.
- No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.

TOBACCO.

- No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
- No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
- No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
- No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
- No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
- No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
- No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
- No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
- No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
- No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
- No. 746. The Development of the Tobacco Industry in Southern Rhodesia. A Historical Survey, by D. D. Brown, Chief Tobacco Expert.
- No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
- No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.

- No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
- No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. Agri.), Tobacco Adviser.
- No. 828. Seed Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.
- No. 835. Tobacco Culture—Transplanting Operations, by D. D. Brown.
- No. 839. Tobacco Experiment Station, Salisbury—Report of General Crop Experiments, by C. A. Kelsey-Harvey, Manager.
- No. 840. Curing Tobacco by the Leaf Method v. Curing on the Stalk, by W. Collingwood-Evans, B.Sc. (Agri.).
- No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.
- No. 885. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown, Chief Tobacco Officer.
- No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.
- No. 955. Annual Report of the Tobacco Branch for the year ended 31st December, 1934, by D. D. Brown, Chief Tobacco Officer.

LIVE STOCK.

- No. 624. The Construction of Dipping Tanks for Cattle (Revised).
- No. 749. Dehorn your Commercial Cattle, by W. Fleming, Stock Adviser.
- No. 801. Sheep Farming in the Melssetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melssetter District.
- No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.
- No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.
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- No. 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.
- No. 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer.

DAIRYING.

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- No. 844. Southern Rhodesia Milk Recording Scheme.
- No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.
- No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.
- No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.
- No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.
- No. 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer.

VETERINARY.

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- No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
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- No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
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- No. 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.
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FORESTRY.

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- No. 874. Tree Planting, by the Division of Forestry.
Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.
- No. 888. The Vegetable Ivory Palm (*Hyphcne ventricosa*), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.
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HORTICULTURE.

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ENTOMOLOGY AND PLANT PATHOLOGY.

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- No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.
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A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
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- No. 896. A List of Plant Diseases Occurring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
- No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 899. The Black Maize Beetle (*Heteronchus licus* Klug), by C. B. Symes.
- No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.
- No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.
- No. 911. Screw Worm: A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Forward by R. W. Jack, Chief Entomologist.
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- No. 951. Suspected "Streak" Disease of Maize. Notice to Growers. By J. C. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

POULTRY.

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- No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.
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- Tuberculosis, by A. Little, Poultry Expert.
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- Preparing Birds for Show, by A. Little, Poultry Expert.
- The Fowl Tick (*Argas persicus*), by A. Little, Poultry Expert.
- Culling: A Seasonal Operation, by A. Little, Poultry Expert.
- Choosing a Male Bird, by A. Little, Poultry Expert.
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- Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
- Seasonal Hints—August, by A. Little, Poultry Expert.
- Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
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- Hints to Breeders. Prepare for the Breeding Season, by A. Little.
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Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

- No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

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No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
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No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.
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- No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.

THE RHODESIA Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

OCTOBER, 1935.

[No. 10.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Warning to Tobacco Growers.—After consultation with the various interests concerned, the Minister of Agriculture and Lands considers it advisable to warn all tobacco growers that if next season's crop—1935-36—amounts to as much as 80% of the 1933-34 production of saleable leaf, it will, as far as can be seen to-day, be considerably in excess of known market requirements.

Growers are therefore advised, in their own interests, to limit production in accordance with the requirements of visible markets, and to continue to concentrate on the production of high quality tobacco of all types.

The Government has decided, after full discussion with representatives of the buyers and of the Rhodesia Tobacco Association, to introduce legislation at the next Session of

Parliament, having for its object the allocation of basic sales quota certificates to growers, with a view to limiting sales of tobacco to the recognised protected markets, namely, those of the United Kingdom, the Union of South Africa, and the local trade. This legislation, when enacted, will apply to the 1935-36 crop, and it requires to be remembered that the needs of these protected markets as far as is at present known, are very materially less than 80% of the saleable crop produced in 1933-34.

Any grower, who for any reason may consider that he is unduly prejudiced by the adoption of 80% of his 1933-34 production (*i.e.*, saleable production plus the contribution made to the Reserve Pool) as the basis for his basic sales quota certificate for the season 1935-36, or any grower who is dissatisfied with the allocation made to him last year by the Committee appointed to investigate and allocate production quotas, may not later than the 31st October, 1935, make application to the Committee which has now been appointed by the Minister of Agriculture and Lands, and which will advise what new or revised basic quotas can be authorised. Any person growing tobacco on his own account for the first time in the season 1935-36 should likewise apply to this Committee for the allocation of a basic sales quota certificate; failing which he will be ineligible to market any portion of his 1935-36 crop in the protected markets.

Under the legislation proposed, and assuming that the production of tobacco in the Colony in 1935-36 is in excess of the known requirements of the protected markets, each grower will be permitted to sell into these markets only such percentage of his basic quota as in the aggregate will provide for sufficient tobacco to meet the needs of those markets. Sales of tobacco into any other markets than those referred to above will for the present remain uncontrolled, but as will be appreciated the profitable openings for the sale of tobacco afforded by these markets are uncertain.

Fattening Bullocks on the Eastern Border.—There has been a good deal of discussion lately regarding the possibility of establishing Cold Storage Works at both Umtali and Beira.

Such a possibility seems to be considered now much more favourably than ever before and has helped to focus attention upon the undoubted possibilities offered by the Eastern Border for the fattening of bullocks for the chilled meat trade. It appears to have been the general opinion that such work could not prove an economic success if such animals had to be railed to Bulawayo for slaughter. In this connection it is interesting to record the success achieved by Mr. P. G. Hulme, of Hawkeshead, Penhalonga, recently. The first lot, of which we have full particulars, consisted of eleven Aberdeen Angus grade bullocks bred by Mr. Hulme. They were shipped to the Cold Storage at Bulawayo early in August and the grading report stated that they were about five years old and of very even shape and type. They were in excellent condition, very well finished with no bruising or blemishes. The quality was excellent and the average cold dressed weight was 616 lbs. We understand that this was the first shipment of bullocks fattened in the Umtali district to be sent to Bulawayo and we shall await with interest the reports on the further lots now being prepared and wish Mr. Hulme every success in his undertaking.

Annual Milking Competition, 1934.—The following are the results of the Southern Rhodesia Annual Milking Competition which was held last year. This competition was open to farmers who made butter or cheese or who supplied cream to a creamery or milk to a cheese factory; dairymen who supplied milk for town consumption were not eligible to compete.

Competition A.—For the 15 cows showing the highest average milk production in a lactation not exceeding 300 days.

1st Prize.—“The Kilburn Cup” and a Cream Cooler, presented by Messrs. The Rhodesian Co-operative Creameries, Ltd., Bulawayo.—Winner, C. J. Orford, Esq., Manda, Rusape. Average milk production per cow 7,780.96 lbs.

2nd Prize.—One 5 gallon Cream Can, presented by The Rhodesia Export and Cold Storage Co., Ltd., Bulawayo.—Winner, P. S. Timms, Esq., Chitora, Rusape. Average milk production per cow 6,506.64 lbs.

3rd Prize.—One 3 gallon Cream Can, presented by Messrs. The Bulawayo Creamery, Bulawayo.—Winner, C. & W. Fischer, Coldstream, Headlands. Average milk production per cow 6,379.78 lbs.

Competition B.—For the 15 cows showing the highest average butterfat production in a lactation not exceeding 300 days.

1st Prize.—“The Fischer Cup” and $\frac{1}{2}$ ton of Monkey Nut Cake, presented by the Express Nut Oil and Soap Works Co., Salisbury—Winner, C. J. Orford, Esq., Manda, Rusape. Average butterfat production per cow 320.38 lbs.

2nd Prize.—Dairy Utensils to the value of £1, presented by Messrs. Meikles (Salisbury) Ltd.—Winner, P. S. Timms, Esq., Chitora, Rusape. Average butterfat production per cow 246.15 lbs.

3rd Prize.—One 4 gallon Cream Can, presented by The Midlands Dairy, Gwelo.—Winner, Messrs. C. & W. Fischer, Coldstream, Headlands. Average butterfat production per cow 234.68 lbs.

Congratulations are extended to all prize winners, especially to Mr. C. J. Orford, who has now secured first prizes in both competitions for two years in succession.

Grateful acknowledgement is made to Messrs. The Express Nut Oil and Soap Works Co.; the Rhodesia Co-operative Creameries, Ltd.; Messrs. Meikles (Salisbury) Ltd., Salisbury; the Rhodesia Export and Cold Storage Co., Ltd., Bulawayo; the Bulawayo Creamery and the Midlands Dairy, Gwelo, for the donations of special prizes.

A Grass of Great Promise.— Among the native grasses of Southern Rhodesia are a number which would compare favourably with the best grasses known anywhere in the world. Not only are they exceedingly attractive to cattle but they also produce a large quantity of growth of high feeding value, and several of them are easily established. To obtain lasting results, however, these grasses must be looked upon as perennial crops, and must be carefully managed and fertilised as crops. Thus Rhodes grass—as a crop—is firmly established at least on the red soils. Its place on sand veld, as a rotation

crop for tobacco is almost assured. The so-called "false" paspalums, grasses belonging to the genera *Brachiaria* and *Urochloa*, have not yet received the attention they deserve. Unfortunately the best known *Brachiaria*, i.e., *B. brizantha*, is particularly subject to a leaf-spot in the later part of the season, which renders it less attractive to stock, but among the *Urochloas* there are at least three species of outstanding merit. These are *Urochloa bolbodes*, most common in Western Matabeleland, *U. pullulans* of the Mazoe Valley, and *U. mosambicensis* which is widely scattered but appears to be really at home in the Sabi Valley. This last named species is known by several common names such as "Sabi grass," "Gilchrist grass" and "Gonya grass." The following notes by Mr. G. Sayers, of Gwelo, indicate the possibilities of this grass.

I secured a stool of this grass from Mr. C. J. Gifford, Junction Gate, Chipinga, in September, 1934, Mr. Gifford having collected same from the Sabi Valley. This stool was broken up into about a dozen plants which were planted in sandy loam soil and watered by hand until the rains started. In December a cutting, about 2 feet in length, was taken off this and the roots split up, single roots being planted 18 inches by 24 inches apart between maize ($\frac{1}{4}$ acre). This second planting yielded a heavy cutting of fodder in March, the maize having been previously cut for silage, thus allowing light for the grass. A further supply of roots was obtained by taking half of each plant and again splitting up. Altogether by the end of March over half an acre had been planted from one original stool. This acreage, however, could have been more than doubled as the last planting was left to natives unattended and the roots were placed only a couple of inches apart in the rows. Also only half of each plant was used in this planting. After the last cutting the grass was allowed to grow to a height of about six inches and then grazed; the cattle were ravenous over it. Although the grass is on dry ground, it has continued to send out green shoots throughout the winter, but these have been checked back with the frost, except where protected to a certain extent by old growth. At the time of writing the grass continues to send out luscious green shoots, although the ground is very dry.

Seed Oats Wanted.—The Department of Agriculture has several enquiries for Kherson and Kinvarra seed oats and request farmers who can supply seed of these varieties to send particulars of quantity available for sale and the price. Replies should be addressed to the Agriculturist, Box 387, Salisbury.

"The Natal Mercury" Competition.—A good deal of interest is bound to be taken in the Farm Management Competition which is to be run for four years in three different areas in Natal. The competition has been organised in conjunction with the staff of Cedara School of Agriculture and will be judged by officials of that institution. Area No. 1, comprising Camperdown and Richmond, will be judged on the results of the 1935-36 season; No. 2, Estcourt-Lions River, on the 1936-37 season, and No. 3, Harding-Kokstad, on the 1937-38 season. The farmers placed first, second and third in each area will compete during 1938-39 season for "The Natal Mercury" trophy, valued at £25. The object of the competition is to induce, encourage, and assist those farmers who are progressive and desirous of learning how best to bring about economic production. The results of farm management will be judged on two dates in the year by an experienced official from the School of Agriculture, Cedara, who will not only pass judgment on what has been done, but will point out in which direction better results might be obtained.

The judging of the competition will not be based on: Who has the best land; the most expensive buildings; the best bred stock; the most complete machinery and implements. Indeed, the fortunate possessor of these may be at a disadvantage, because the official judging will at once place his finger on the fact that the farm is not being run as an economic proposition, but the owner is evidently conducting operations as a hobby, and expending money on it which has not been earned by the farm, and the expenditure will never be justified from an economic point of view.

Neither will a large farm have an advantage over a smaller one, for the reason that the larger the farm the greater the need for skill to make it an economic proposition.

A very interesting description of the objects and requirements of the competition was prepared by Mr. G. D. Alexander, Associate Agricultural Editor of *The Natal Mercury*, and Mr. John Fisher, the Principal of Cedara School of Agriculture. This contains a printed schedule which is to be used in allocating all labour costs—both man and animal—under the different farm headings. This would undoubtedly be of great interest to many Rhodesian farmers, and there is little doubt that a copy could be obtained on application to *The Natal Mercury*, Box 950, Durban.

Fruit Supplies in Great Britain in 1934.—During August the Imperial Economic Committee issued a report on the production of and trade in fruit throughout the world. It has now published, as a supplement to its Weekly Fruit Intelligence Notes, its annual survey, "Fruit Supplies in 1934," in which attention is more particularly focussed on the amount of fruit available for consumption in the United Kingdom.

The most remarkable fact disclosed by this survey is that although imports of raw fruit in 1934 were over 100,000 tons below the record quantity imported in the previous year, the inhabitants of the United Kingdom ate more fruit than ever before. This was due to a bounteous home crop, especially of apples, which brought the total available supplies up to a figure rendering possible a per caput consumption of nearly 96 lbs.

Although the production of fruit in the United Kingdom is increasing, on an average about three-quarters of the supplies available for consumption are imported from overseas. In the past twenty-five years the trend of raw fruit imports has been consistently upward, and imports are now nearly twice as great as before the war, the average for the five years 1929-33 being well over $1\frac{1}{4}$ million tons as compared with less than $\frac{3}{4}$ million tons in the period 1909-13. The bulk of the total is still supplied by foreign countries, imports from which are some 50 per cent. greater than in pre-war years, but a relatively much greater advance has been made by Empire countries, whose contributions in the five years 1929-33 averaged more than four times the pre-war quantity.

Imports of raw fruit from Empire countries reached a new high level in 1934, accounting for 622,000 tons out of a total from all sources of 1,354,000 tons. This quantity represented nearly 46 per cent., as compared with the previous highest figure of 41 per cent. in 1933 and an average of only 20 per cent. in 1919-23.

The survey, in addition to its analysis of the imported supplies of fresh fruit in the United Kingdom, contains brief reviews of the trade in other countries, and should be invaluable to all those interested in an Empire industry of growing importance.

The following letter has been received from Capt. J. M. Moubray, Chipoli, Shamva:—

“On reading the September number of the *Journal* two statements stand out which, if put together, can be of great assistance to the farmer. Mr. Tapson, on page 605, describes how cheaply a pit can be dug, and we have the exploded idea of the Enterprise farmers that you get a better return by burning off sunn hemp than by ploughing it in. (See tables from the Experimental Station.) One fact is very noticeable on fields where the sunn hemp has been burnt off, and that is the complete or almost complete loss of ash owing to the high winds we get at this time of year, so that the ash factor can be discarded for all practical purposes. The almost total benefit then that accrues from burning is from the root system left in the ground. No one will, I think, question the value of farmyard manure.

If instead of burning the sunn hemp it is cut and turned into farmyard manure, by being used as bedding for cattle, then this can be easily accomplished. If no means are available for doing this, perhaps through the lands being situated some distance from the cattle kraals, then compost can be made in pits—the finished article being often as good and sometimes better than average kraal manure. I have for many years made this product not only from sunn hemp but from reeds, weeds, grass, cotton plants and even from tobacco stalks. The latter take longer to rot, but in the end produce an excellent compost. I was given a formula some years ago

by the Union Department of Agriculture, and with slight variations have found it excellent. Dr. Brain tells me it produces practically the same effect as the Adco mixture. To each ton of raw material add 65 lbs. sulphate of ammonia, 55 lbs. lime and 25 lbs. superphosphate. I sometimes substitute 100 lbs. wood ash for the lime and 30 lbs. raw rock phosphate for the super, both seem to act equally well.

The process requires water, and here may be the difficulty for some farmers. The pits after being filled should be flooded and not allowed ever to get dry. I find no limit to the size—it is just a matter of convenience. Some farmers may find it easier to work with two or three small pits rather than with one large one. If done properly sunn hemp can be turned into excellent compost in three months. I would very strongly urge farmers not to waste sunn hemp by burning, but if they must remove the foliage and stems before ploughing, to cut it and compost it. This, returned to the land plus the root system which has been left behind, will show a remarkable increase in the following year's crop, not only by its plant food value but also through its humus value in retaining moisture which would otherwise be lost.

One of the most interesting books on the manufacture of compost is Howard's "Waste Products of Agriculture." He does his work with materials produced on the farm, using urine earth instead of an ammonia salt and so on, but his process is designed for producers working on a much smaller scale than most farmers do in this country.

From the original compost pits on this farm the practice spread to the Mazoe Citrus Estate where, I understand, they now have over one hundred such pits and make excellent compost out of orange skins.

Wood ash should be kept dry as otherwise the lime in the ash reverts to the carbonate, when its action in the pits is not nearly so efficient. As the ash on this farm is produced from the tobacco barn furnaces it is stored in a building close to the pits, from which it is drawn and spread on the compost mixture as required.

Compost can be made when the vegetative growth is at its highest—at a more or less slack time on the farm—when cultivation is over and harvest has not yet begun."

NOTICE.

Committee to Advise on Basic Sales Quotas to Tobacco Growers.

It is intimated for the information of those concerned, following on this Department's Warning to Tobacco Growers published in the *Government Gazette* on the 6th September, 1935, that the Minister of Agriculture and Lands has appointed a Committee to advise as to what new or revised basic quotas may be granted to growers.

The personnel of the Committee is as follows:—

Lieut.-Colonel Donald McDonald, O.B.E., V.E.
(*Chairman*).

Hans Garmany, Esquire.

William John Atherstone, Esquire.

Any tobacco grower who for any reason may consider that he is unduly prejudiced by the adoption of 80% of his 1933-1934 production (*i.e.*, saleable production plus the contribution made to the Reserve Pool) as the basis for his basic sale quota certificate, as foreshadowed in the proposed legislation to be introduced at the next Session of Parliament, or any grower who is dissatisfied with the allocation made to him last year by the Committee appointed to investigate and allocate production quotas, and likewise any person growing tobacco on his own account for the first time in the season of 1935-1936, should, not later than the 31st October, 1935, represent his case in writing to the Chairman of the Committee appointed above, addressed to P.O. Box 387, Salisbury, for consideration.

It will materially assist the Committee in its investigations if applications submitted to it could embrace the following information:—

- (a) Acreage planted and total number of pounds produced each year over a maximum period of five years.

- (b) Average yield per acre each year within that period.
- (c) Number and size of barns on the farm.
- (d) Number of Europeans employed in growing the crop stating whether married or single.
- (e) Whether the applicant is the owner or lessee of the farm on which the crop is produced: if a lessee the period of the lease and rent payable should be stated.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Cactus Slabs (blades) Algerian and Moscatel varieties, per 100 Slabs 5/- delivered at the Salisbury Experiment Station, or 7/6 delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made on orders received before October 31st, 1935.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns and Cactus Slabs during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury. (Oct.-Nov.)

Department of Agriculture and Lands.

IMPROVED U.4/64 COTTON SEED.

Seed of the newer, U.4/64 strains, mainly improvements on U.4/64/7/10 (Gatooma 5-11), are available for sale to growers, in 50 lb. lots, at a charge of 5/- per lot.

The seed has been grown during the past season on the Government Cotton Breeding Station, Gatooma, and is approximately 70% sound.

Applications for cotton seed must be accompanied by a Postal Order or cheque for 5/- made payable to the Accountant, Division of Agriculture and Lands, Salisbury. Exchange must be added if cheques are not drawn on Salisbury.

Applications for seed should be addressed to the Plant Breeder in Charge, Cotton Breeding Station, Gatooma, as early as possible. They will be dealt with in the order in which they are received.

For bulk quantities of U.4/64 strains, grown from earlier Gatooma issues, application should be made to the Bindura Ginnery, Bindura.

H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

23rd August, 1935.

(Sept.-Nov.)



A fifty acre field of Rhodes Grass on Glenara Estate
(Messrs. Newmarch & McLean).



Paddock of Rhodes Grass on A. C. Kilburn's farm, Blencartha,
Trelawney.

Rhodes Grass for the Rhodesian Tobacco Grower.

By African Explosives & Industries, Ltd.

The great majority of tobacco growers have at one time or another found difficulty in keeping their cattle in good condition at the very time they are most needed, due chiefly to the lack of grazing during the winter months and in the early spring, before the arrival of the rains. Experience during the past few years has proved the value of certain grasses, by which this state of affairs can be avoided.

Particularly promising among these grasses is *Rhodes* grass, which has now been established on all types of soil in Rhodesia, and has given excellent results. One of the advantages of this grass is that it is readily established from seed, which can now be obtained in the country at a very reasonable price. Another very important factor is that it is suitable for both grazing and hay making. It can be cut within a few months of sowing and the hay obtained can be utilised for feeding during the dry winter months. This hay is readily eaten by all animals; in fact, it is so palatable that it will be found necessary to fence off the hay ricks in order to preserve it for the period when it is required. At least two cuttings of hay can be made each year and yields of 4 tons per acre have been obtained. After the hay crops have been reaped the stubble will provide good grazing for a couple of months, and provided the grass has been well treated will green up in October and again provide grazing during this month and November. When the veld grasses appear after the first rains grazing should be discontinued on the Rhodes grass in order to allow this to grow and provide hay for the following dry season.

The two photographs shown will illustrate what can be expected on sand veld and on heavy red soil.

Rotation Crop.—In addition to the important question of providing feed for his cattle, there are other reasons why the tobacco grower should interest himself in this grass. Firstly, there is the very vexed problem of a suitable rotation crop for tobacco.

It is generally agreed that although the ideal would be for every grower in Rhodesia to be a mixed farmer, this does not always work out in practice. The best tobacco is undoubtedly grown on our sand veld, and maize on the heavier soils. In a few isolated seasons good tobacco has been produced on these heavier soils, but on the average the results are very disappointing and have added largely to the quantity of low grade tobacco placed on the market. On sand veld it is seldom that a payable crop of maize is produced, and where this crop is utilised as a rotation for tobacco, it depletes the soil so severely that the land becomes useless for future tobacco crops. In the past thousands of acres have had to be abandoned chiefly for the want of a suitable rotation. This state of affairs cannot continue indefinitely and it is essential that a suitable rotation crop be found. While a sufficient period has not elapsed since the adoption of "Rhodes" grass in Rhodesia as a crop to prove its full value in this direction, it would appear from results so far obtained that it is the most suitable rotation crop available, and one which will give a monetary return through the cattle on the farm.

The actual periods of such a rotation, to give the best results, have not yet been determined, but we would suggest that after two years of tobacco, the land should remain under Rhodes grass for four years before being again used for tobacco.

Nematode Control.—Secondly, the question of the control of eelworm is of the greatest importance to tobacco growers, and as years go by will be an increasing problem unless steps are taken to control it. One of the recognised method of control is to plant immune crops such as Rhodes grass, and if the above-mentioned rotation is carried out it should help tremendously in preventing the pest from rendering soils useless for future tobacco crops.

Preparation of Land.—A good seed bed is essential. After the removal of the tobacco stalks the land should be well ploughed and harrowed. The amount of seed required per acre is eight pounds, and to ensure even distribution should be mixed with a carrier, such as mealie meal or sawdust. After sowing the land should be lightly harrowed, and for this purpose a branch of a tree will be found very suitable.

Fertilising.—The chief requirement of all grasses is nitrogen, and it is essential that this plant food be applied, otherwise the rotation will be a definite failure.

After two years of tobacco an application of sulphate of ammonia at the rate of 100 lbs. per acre some six weeks after sowing should be made. There should be sufficient residual phosphate and potash in the soil from the tobacco fertiliser applied during the previous two years to supply the requirements of these two plant foods for the first year.

In subsequent years it is advisable to apply a mixed fertiliser just before the rains commence and sulphate of ammonia as a top-dressing later in the season.

Notes from the Cotton Station, Gatooma, 1935.

By J. E. PEAT, Empire Cotton Growing Corporation.

For the last two seasons short articles have appeared in the *Rhodesia Agricultural Journal* dealing with the work and results of the Cotton Station, Gatooma. It is considered advisable to re-write these notes each year, discussing points in the growing of the crop which, as a result of the experience of the preceding season, require stressing.

It has to be emphasised that most growers do not understand fully the importance of a sound seed supply, and do not differentiate properly between the breeding of the seed stock and the ordinary germinating capacity or viability of the seed itself. For a number of years pedigree seed has been issued from the Cotton Station, Gatooma; yet at the Ginnery few lots, even lots intended for seed, are labelled with their strain number.

Again, the importance of early planting of the crop has been stressed repeatedly. Yet this past season many growers planted their cotton much later than need have been, up to a month following the planting rains, and after most of their maize had been planted. Many of them, in addition to suffering more seriously from the drought, also suffered severely from American bollworm attack. Further, many growers do not yet appreciate that some mitigation of American bollworm attack may be achieved by having an area of late maize, or other crop, flowering in February-early March, the most critical period for the making of the cotton crop.

Season.—The past season has been a very difficult one. In most areas there was too much rain in the early part of season, which checked the young plants, and made them too sappy. Following on this came a severe drought of five weeks in February-March. This is the critical period for the making of the crop, the period when flower buds have been laid down and plants are beginning to flower freely. In spite of their "sappiness" the plants stood up to the drought quite well

for about the first three weeks, but for the last two weeks suffered heavily. They shed leaves, bolls, and flower buds. Plants on land in fair heart suffered less, especially as they had got away better in the early months. On really poor land plants shed the greater part of the crop. A certain recovery took place when the drought broke, especially with crops on better land, and in April and May plants were flowering again quite heavily. But the winter has been the coldest recorded for many years, and the top crop was unable to develop properly. A good late top crop would have been picked from many crops in August-September had the winter been as mild as those of the last two seasons.

Seed.—This year again lots of pedigree seed for multiplication are being issued from the Station. It is of the greatest importance that some track should be kept of these seed issues. Strains are numbered with a family number, which shows the line of breeding, *e.g.*, U4/64/7/10/1. These family numbers, for the ordinary grower, are now a bit complicated but, in addition, the strains are numbered with a more simple Gatooma number, *e.g.*, Gatooma No. 5.30.

In the breeding work a considerable number of strains are handled. After being grown a year or two under a fair range of conditions, certain families show up much better than others. It is intended, ultimately, that only seed of the best families should be recommended for issue from the Ginnery seed pool for commercial seed purposes. As seed in the "Seed" pool fetches a much better price than seed in the "Cattle Feed" pool, it is immediately in the grower's own interests to try to get as much seed as possible into the "Seed" pool. When sending to the Ginnery seed cotton grown from pedigree seed, growers should label woolpacks carefully with the strain number. To take advantage of the improvements being effected, it would pay growers to get a fresh supply of pedigree seed from Gatooma every two or three years.

American Bollworm.—The extent of American bollworm damage this past season has been somewhat obscured by the heavy loss caused by the drought. The majority of growers suffered however, and a few growers suffered severely. American bollworm damage is the most serious obstacle to successful cotton growing in most areas.

Again this past season the importance of early planting, and of early "get away" of the crop, has been very apparent. This is so important that it might be said that if the cotton crop cannot be planted, say, within a fortnight of the planting rains, it is definitely better that, for that year, it be not planted at all. Cotton should always be one of the first crops to be planted.

The reason for this is that with a normal time of planting the American bollworm egg-laying on the cotton crop starts about the middle of February. Around this time the American bollworm moths, which up to then have been egg-laying on large areas of attractive maize, cease to lay heavily on maize, the greater part of which is now getting past the tasselling stage. These moths tend to concentrate on other crops then flowering. Cotton is one of the few crops flowering freely, and thus highly attractive at that time. If the moths concentrate in numbers, a serious bollworm attack may follow about a couple of weeks later.

If the cotton crop is planted early and gets away well, a fair crop should be set before the peak of this American bollworm attack. But with late planted cotton few bolls are old enough to escape attack. The crop therefore suffers very much more heavily and the main crop may be lost.

If thinning is unduly delayed the crop gets a set-back almost equivalent to a semi-late planting. In the same way any checking, by weeds, in the early stages, growing on land which has been fallow the previous season, or on land which has been left in too fine a tilt through the winter, all tend to make for a late crop.

With our knowledge of the habits of the American bollworm moths, it follows that if areas of crops, other than cotton, are at the attractive stage, the flowering stage, from about the middle of February into early March, then they attract the egg-laying of a portion of the American bollworm moth population present, and thus reduce the severity of the attack on cotton. With areas of other crops, additional to cotton, attractive, it is unlikely that such serious American bollworm loss will be suffered, as some growers have experienced in the last few years.

The accompanying chart illustrates the time-of-planting programme on the Cotton Station this last season, when the dates of planting of all crops, other than cotton, were regulated, to give the maximum protection to the cotton.

Some modification of this idea of regulated planting dates should be economically practicable on most farms. With early planting of cotton, in a season when it can be planted around the third week in November, a portion of the commercial plantings of maize could be planted, somewhere in the same area as where the cotton is growing, up to about the middle of December. As seasons are so erratic, over a period of years there should not be much, if any, loss in total maize yield, by having a portion of the ordinary commercial maize planted up to around the third week in December. Although in most years early planted maize probably does best, there are years when the December planted maize does well.

Some ensilage maize could be planted around the end of December. In a season of late planting rains the time of planting of this late maize would have to be regulated by the date at which it was possible to plant cotton.

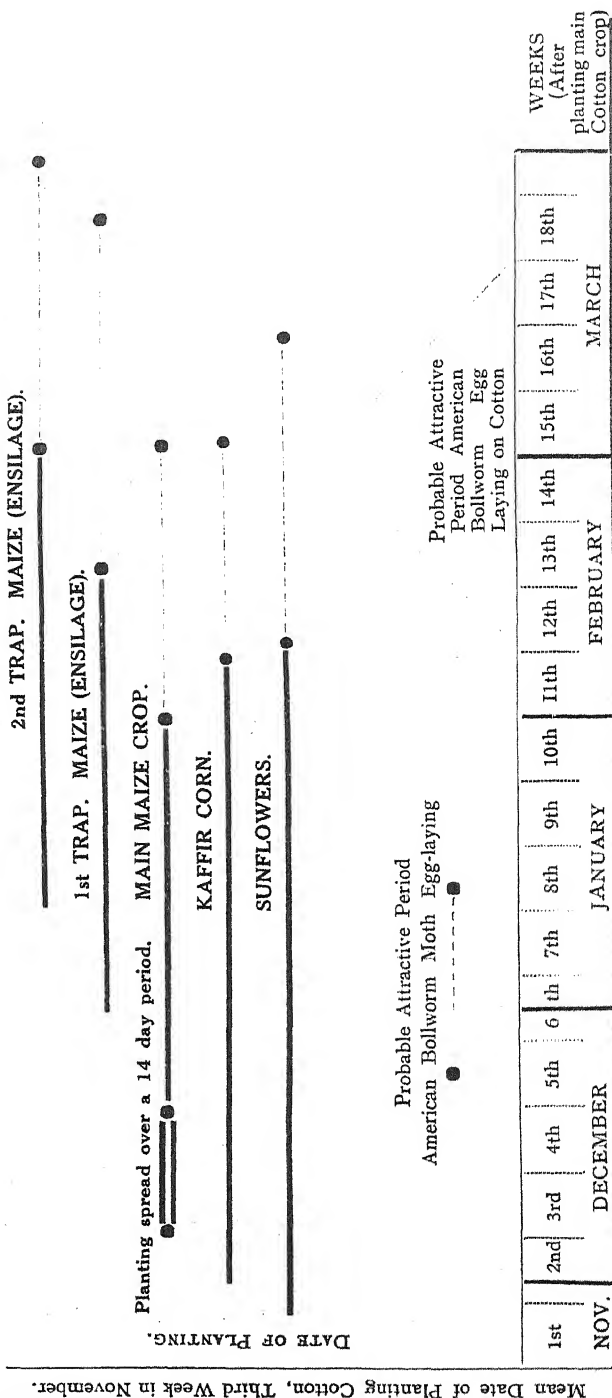
Other crops flowering towards the end of February also assist. Heavy egg-laying always occurs on tobacco plants flowering at that time.

But these other crops, to be of assistance, must be attractive over the critical period, mid February-early March. If they flower earlier and later than that period, they do not affect the cotton—American bollworm position. For example, looking at the chart, if sunflowers are not planted fairly soon after cotton—if the planting is delayed, say, until the end of December or early in January—the period of flowering comes too late to benefit the main part of the cotton crop. In the same way the second planted trap maize in the chart was attractive rather too late to be of much help.

It is not possible yet to give much information about the optimum size of such blocks of other crops, relative to the cotton acreage, but speaking generally, it may be said that the bigger they are the better. A few lines of late maize in a strip through the cotton field are not of much use.

Schematic Planting Programme Protection against American Bollworm.

**COTTON STATION,
GATOOMA, 1934-35.**



Sudan Bollworm.—From the point of view of breeding up Sudan bollworm, it appears to be safe to leave cotton plants on the land until the rains break. For example, this season, had the winter been mild as the two previous winters have been, a late top crop could have been picked off in August-September. Then cattle could have been turned in to graze on the plants. This could have been done quite safely, without risk of breeding up Sudan bollworm. But leaving plants in the ground after November is dangerous. Sudan bollworm moths emerge from pupation with the first rains. They lay their eggs on any cotton that is still growing, breeding up to attack the annual crop later in the season. It follows, therefore, that any system of stand-over or ratooned cotton is dangerous. After a period of years, with stand-over or ratooned cotton being grown generally, it would probably be impossible to pull off successful annual crops.

Stainers.—There is little to add to what has been written in previous notes about mitigation of stainer damage. The earlier the crop, and the earlier it can be reaped, the better, and the less likelihood is there of serious stainer damage. It is always the later portion of the crop, the top crop, that suffers most.

Another point to remember is that once the crop has opened, stainers feed on the seed in the open bolls. And although at this stage the damage is not so apparent, in that there is no staining of the lint, they cause a staining and rotting of the seed. It is important therefore for this reason, apart from others, that the portion of the crop intended for seed should be picked as early as is practicable.

A percentage of unsound seed, caused mainly by stainer damage, is usual with cotton seed in Rhodesia. Ordinary commercial seed shows a percentage of sound seed of from about 60% up to 90% or more. But from seed cotton that has been picked late in the season the percentage of sound seed may drop as low as 30%, or even lower. That there is this percentage of unsound seed in the majority of seed samples must be borne in mind, and is one of the reasons why, in planting, a high seed rate is necessary. It is unnecessary to remind growers how important a factor a good stand is for a successful final yield.

The season has been such that the February-March trapping of stainers on cotton seed heaps produced poor results. This trapping may be worth while in seasons when February and early March are rainy. Experiments with this trapping are being continued at Gatooma.

Picking.—With some growers there is a tendency to leave the cotton too long on the plants before beginning to pick. From every point of view it is better to pick in at least two pickings, provided reasonable pickings per boy can be made. Not only does stainer damage of seed increase the longer the seed cotton is left in the field, but there is a bleaching of the lint which lowers somewhat the value. The longer seed cotton is left in the field the more trash and dirt is blown into it, and the more difficult it is to pick fairly cleanly at picking time.

It does not pay to waste too much time in picking too cleanly, but, on the other hand, some of the seed cotton coming into the Ginnery this season contained an excessive amount of broken leaf and trash. Lint containing much broken leaf and dirt fetches a lower price. It should be possible to pick around 40 lbs.-50 lbs. of seed cotton per boy per day, without sacrificing cleanliness.

It has been suggested that, for the benefit of those growers who have little experience of growing the crop, the following short notes on the more elementary aspects of cotton growing might usefully be added to the above article.

1. **Time of Planting.**—As has been discussed above, the earlier the crop can be planted after the planting rains, and the quicker it can be got away in the early stages, the better.

2. **Seed Rate.**—To ensure a good stand, with a machine planted crop, it is necessary to plant about 30 lbs. of seed to the acre. This seed may be treated with mud before planting and then dried. The caked mud on the fuzz enables the seed to run more easily through the planter. With hand planting a lower seed rate can be employed. With the 3 feet by 1 foot spacing, four seeds to a hill, the planting rate would be about 10 lbs. an acre. This would be a fair seed rate for the

multiplication of pedigree seed. For the hand planting of a commercial crop a seed rate of around 15 lbs.-20 lbs. per acre would be advisable.

3. **Depth of Planting.**—It is very important not to plant cotton seed too deeply. Seed should just be covered by the soil. In machine planting “shoes,” as illustrated in the *Rhodesia Agricultural Journal*, Vol. XXVIII., No. 10, October, 1931 (Major Cameron’s Departmental Bulletin No. 831), may be affixed to the runners of the planter to prevent the seed going too deep. If the seed is planted deeply, a fair percentage of the plants may die off before reaching the surface.

4. **Spacing and Time of Thinning.**—Thinning should be done about a month to five weeks after planting, when plants are getting into their second and third leaf, and are about 4 inches high. If thinning is unduly delayed, the competition of the plants checks development. The rows are normally 3 ft. to 3 ft. 6 inch apart, and on the run of soils plants may be thinned out to one plant to a hill with 6 inches between plants, or two plants to a hill with a foot between hills; when gaps occur wider than a foot three plants to a hill should be left. On richer land, with early planting, a slightly wider spacing might be employed.

5. **Early Cultivations.**—It is important that the crop should not be checked by weeds in the early stages. The early cultivations and hand hoeings are the important ones. If the land tends to be weedy, the crop should be cultivated before thinning, and hand hoed after thinning. Two more hand hoeings, and probably another three cultivations, would be about normal, but everything depends on how weedy or otherwise the land is. It is unwise to cultivate after the crop has started flowering freely. The cultivation immediately before this should not be so deep a one as to destroy the lateral plant roots.

6. **Soils.**—For optimum response cotton, like most other crops, requires to grow on land at least in fair heart and fertility. On good land cotton gets away earlier, sets a bigger frame, flowers and fruits more freely and is better able to come through a drought period. It will grow and produce

reasonable crops on a range of soils, but for optimum results it requires soil of fair depth and good drainage to allow of proper root development.

On exceptionally rich land, in a year of good rainfall, there is a tendency for the plants to grow rank.

7. **Fertility and Need of Humus.**—On most red soils it does not pay to fertilise cotton directly, but good results are obtained following other crops, such as maize or tobacco, which have been fertilised. On the lighter soils cotton may respond more freely to direct fertilising. Most soils in this country are deficient in humus, and undoubtedly more must be done to remedy this defect. When a longish dry spell occurs in February-March, the loss of crop is much heavier on land markedly deficient in humus, and the recovery after the drought is much less.

It is not wise, however, to plant cotton immediately following a green manure crop ploughed in. It is better first to take off a maize crop, and then to follow this with cotton. White ants seem to be especially bad after a green manure crop ploughed in. When cotton is planted immediately after, stands are often very seriously reduced by white ant damage. This has happened with several growers this past season.

Feeds for Poultry and How to Use Them.

By G. H. COOPER, Assistant Poultry Officer.

During recent years considerable work has been done and knowledge gained in the use of many feeds for poultry. Most of this work concerns the rearing of chickens and feeding for egg production. Other classes of poultry have had less attention paid to them and also much work in connection with digestibility trials with poultry remains to be done. However, it is felt that a comprehensive list of foodstuffs and the latest knowledge applied to their use for poultry feeding will be of great use at this time to farmers in Southern Rhodesia. Special attention has been given to the use of Rhodesian experience and analyses of feeds where available.

THE FEED STUFFS.

Barley.—This grain is not used to any extent in Southern Rhodesia. Where it is available it may be used, but is not so palatable as maize or wheat. Good heavy grain may be used as a substitute for maize, especially in fattening rations. It may be fed as a scratch grain or in the form of ground barley in the mash, where it may be useful to add variety.

Beans.—Various types of beans are occasionally fed to poultry usually as cracked beans as a grain or in the mash as bean meal. As beans in general are not considered very palatable to poultry they should probably be fed as bean meal in the mash and not form more than 20% of the mash. Velvet beans have been shown to be unsuitable for poultry feeding. If cull beans are available they may be utilised by cooking, which will improve the palatability. The cooked beans should be mixed with a little mash and fed as a wet mash.

Buckwheat.—At present this feed is not extensively grown and it is not eaten readily by fowls. As buckwheat

middlings it may be fed in the mash, but the hulls must be sifted out. When fed to poultry it produces a white flesh and light coloured yolks.

Cotton Seed Meal.—Has been used for poultry feeding with somewhat contradictory results. It is generally accepted as being not a very desirable feed for poultry. It is high in protein and should be fed where used as a protein supplement to the cereal grains. If fed in large amounts it may prove injurious. Not more than 10% of the mash should be fed in the ration.

Cowpeas.—This legume contains a large amount of protein with the essential amino-acids which are lacking in the grains; this is true of most of the leguminous seeds. Cowpeas may be somewhat unpalatable to poultry, but if the birds are accustomed to them whilst young they may be fed to advantage either as a grain or a mash ingredient when ground. They should be used as an additional protein supplement to the cereals. They are usually too expensive for feeding.

Gluten Feed.—Consists of the gluten and bran of maize. It is high in protein but a similar quality to the proteins of the grains and therefore unsuitable for use in mashes as a protein supplement to the cereals.

Hominy Feed.—Consists of the bran or hull, germ and some of the starch. Its composition is similar to maize but is higher in minerals and fat. It is an excellent feed for poultry, but is rarely on the market in this country.

Kaffir Corn and Kaffir Corn Meal.—May be considered fairly palatable and very nearly the equal to maize in feeding value. It has a composition between wheat and maize. It may be used whenever available.

Maize.—The most valuable feed for poultry owing to its high digestibility and palatability. It is produced on nearly every farm and is always available. It cannot be fed, however, without supplements of proteins from other sources. Yellow maize is preferable, as it alone carries Vitamins A and E and is more palatable than white maize. Also it gives a deep yellow colour to the yolk of eggs, and in yellow skinned breeds to the skin pigments. Flint maize has usually a

smaller grain and should not be cracked for poultry feeding. It is also somewhat higher in protein than dent maize. The best maize to feed as grain, therefore, is a fairly small yellow flint which is fed whole. Cracked maize refers to the grain cracked or broken for grain feeding. There is a certain amount of loss and extra cost in grinding which does not improve the digestibility of the whole grain, therefore it should be avoided unless the grain used is too large.

Maize Meal.—Serves the same purpose in the mash as the whole grain does in the scratch feed. It should be ground fairly fine or otherwise the birds will tend to take it from the mash mixture owing to its palatability. Yellow maize is again preferred.

Maize and Cob Meal.—Usually known as corn and cob meal, it is made by grinding the grain and cob together. If the grain is shelled the mixture to be used is four parts of maize meal to one part of cob meal. The cob has little nutritive value, but may be added for bulk in some mashes. Too much cannot be fed.

Maize Germ Meal.—Usually available and may be used for a portion of the maize meal in rations where it is necessary to bring up the protein content slightly without increasing the animal feed. It is slightly higher than maize meal in protein.

Millet Pearl.—Known in Rhodesia as “N’youti” or “Munga,” it is used very extensively as a chicken feed and for laying hens. This variety of millet has not so hard a shell as many others and is more desirable. It is supposed to have a beneficial action upon the kidneys. It is very palatable and so should not be fed in too great quantities, especially to chickens, as it is likely to cause crop trouble. It has a large germ and carries enough Vitamin A to support nearly normal growth, which is important when white maize is fed and green feed is lacking.

It is similar to oats in composition but carries less fibre. (Ground into a meal it may with advantage form part of the mash feed. As a grain it is very useful to induce exercise, as it is small and eagerly sought. For poultry feeding it is considered as valuable as yellow maize.

Milo.—May be considered similar to Kaffir corn but not of quite as high feeding value or palatability.

Oats.—The value of oats depends upon its weight. A light oat, which is mostly hull, is not suitable, and unfortunately most oats grown in this country are considered light. Heavy clean oats or oatmeal is greatly relished by chickens and is a very desirable feed. A small portion of oatmeal is frequently fed to small chickens, but is usually too expensive to feed otherwise.

Pea.—Field peas are usually too high in price to be used as a poultry feed, but pea meal is an excellent feed for all classes of stock, being high in protein and of the correct kind to balance the cereal grains.

Peanut Meal (with shells, not extracted).—This feed consists of the ground kernels and shells and may be successfully used as a mash ingredient for all classes of poultry. It is fairly high in protein, and very high in fat, which is its chief disadvantage. It may comprise up to 20% of the mash for laying hens without causing trouble; however, the mash should contain other feeds low in fibre and oil. It is not so good a feed as the extracted peanut meal, but where peanuts are grown on the farm it may be used with greater economy perhaps.

Peanut Meal (with kernels only).—The ground kernels form a similar feed to that, including the shells, but contain more protein and more fat with less fibre. This feed may be used in small quantities in the mash, but should be used with care.

Peanut Meal Extract (oil extracted meal from unshelled nuts).—This feed has been shown to be an exceedingly valuable protein supplement feed for the cereal grains, being high in protein, carrying the desirable amino-acids. It may be used for all classes of stock and may replace entirely or in part the usual protein rich feeds of animal origin, though it is considered best to use some animal protein feed in conjunction with it. It largely depends upon the current prices what amount of animal feed will be used. When used as the sole protein rich supplement in a ration the necessary minerals must be added by the use of bone meal.

Pollard.—The by-product of wheat in the production of flour. It is similar to middlings, shorts, thirds, etc., and normally contains fine bran and some flour. It is one of the most widely used feeds in all mashers and is an excellent feed, especially when combined with wheaten bran. Too much in the mash should be avoided as it is high in gluten and may form a sticky mass in the mouth and interfere with heavy mash consumption. It must be balanced with proteins from animal or suitable vegetable sources.

Rice.—Is not used to any extent, but may be used as a fattening feed, being high in carbohydrates. It may be used in the grain portion of the ration. Rice by-products may be used to a limited extent only, because of a high fat content.

Soya Bean Meal (oil not extracted).—The soya bean ground into a meal. This feed is high in protein and fairly high in fat and may be used in a mash in a similar capacity as peanut meal (not extracted), but is preferred to the latter because of its higher protein value and lower oil content. It should become increasingly popular when this excellent legume is grown more extensively. It promises to be one of the most useful feeds rich in the proteins necessary to balance the cereal grains which will be available to the farmer without undergoing any manufacturing process. It may be recommended as a protein supplement to the cereal grains and may substitute most of the purchased animal protein feeds if necessary. When ground, the seed should be mixed with a certain proportion of maize owing to its oil content which makes grinding otherwise difficult.

Soya Bean Oil Meal (fat extracted).—Owing to the fact that other products such as peanut and cocoanuts have a higher oil content than soya beans they are not used extensively to-day for oil production. Where they are, however, the resulting cake with the oil extracted is an excellent feed for all poultry and is better than the soya bean meal without the oil extracted. It is very high in protein and possesses all the attributes of the best protein rich supplements for the cereal grains. Where procurable at reasonable prices it may be used with advantage as a protein feed, with the addition of the necessary minerals.

Sunflower Seed.—This seed is extensively used in the grain for adult birds and may form 10% of the grain ration at all times and more especially during moulting periods. This seed is high in oil and must be used with discretion if peanut meal or soya bean meal are included in the mash, as too high a percentage of oil in the ration may cause digestive disturbances. The small black variety is most commonly used. It carries a reasonable amount of protein and is high in fibre.

Sunflower Head Meal (without seeds).—This feed consists of the ground up sunflower head after the seeds have been thrashed out. It is becoming popular in certain areas where wheaten bran is expensive. It is used as a bulky feed and may replace up to 20% of the wheaten bran in a mash. It has been used experimentally to supply the entire bulk in a ration and with apparent success. It is high in fibre.

Sunflower Head Meal (with seeds).—This feed is similar to the last named, except the seeds are not thrashed out before grinding. It is even higher in fibre but also higher in protein and oil. When these feeds are used no other fibrous feeds should be included and too much of these feeds should not be fed. A better grade of meal is produced if ground finely in a hammer mill.

Wheat.—The price of wheat usually makes it too expensive to use as a poultry feed here, but it is one of the best grain feeds for all classes of stock, being very palatable. It may always be included in the grain ration.

Wheat Bran.—A by-product of flour manufacture consisting of the outer layer of the wheat kernel. It is probably the most popular mash ingredient for adding bulk to the ration. It is excellent for mixing with cereal meals, though its protein is deficient and does not help to balance that of the other cereals. It is high in ash, has a cooling effect upon the digestive tract and is slightly laxative. It seems it is fed more for its physiological effect than for its feed value.

Wheat Feed.—When wheat is ground into a meal it forms an excellent ingredient for the mash and may partly replace both the bran and pollard in the mash if used, otherwise it may be used as a feed in any mash according to its value as shown in the table of feeds.

Wheat Screening.—This feed, consisting of shrunken and cracked wheat, may often be purchased at low prices, and if it is free from contamination with weed seeds and dirt is an excellent grain feed for all poultry. Actually shrunken wheat has been shown to be higher in protein than the full plump wheat. Wheat screenings may be ground into wheat feed if desired.

FEEDS OF ANIMAL ORIGIN.

These feeds are used chiefly as sources of proteins to balance the carbonaceous feeds, as birds are omnivorous at least one feed of animal origin in the ration is usually recommended.

Blood Meal.—A by-product of the slaughter house, it is always available and is probably the cheapest form of protein, of which it has a very high percentage. However, all authorities are agreed that it is unpalatable to poultry and is not generally recommended for this reason. A small proportion of the protein feed may consist of blood meal if desired.

Blood (dried).—This product is high in protein but lower than commercial blood meal in this respect. The same remarks as to unpalatability apply, however, but with perhaps less emphasis.

Blood (fresh).—Where this is available it may be used with advantage, and it may often be obtained for the taking away. Fresh blood is palatable and high in protein. It should be fed by mixing with equal parts of wheaten bran and maize meal to form a wet mash. Do not feed it as a liquid to birds as it will make a nasty mess and often leads to feather plucking or toe picking and cannibalism.

Bone Meal.—This product is fed more for its phosphate of lime content than for its protein content, though it has an appreciable amount of the latter. It is therefore more of a mineral supplement, and as such should be used in all mashes for all classes of stock. About 2% in the mash is sufficient.

Bone (fresh cut).—Fresh bones may often be obtained for next to nothing, and when cut in a green bone cutter form a palatable and highly nutritious feed, rich in mineral matter and protein. It should be fed fresh and not more

than 1 oz. per fowl every other day given, otherwise digestive trouble may follow from too heavy feeding. If properly dried in the sun it may be kept satisfactorily. It should not be fed if at all tainted. It fits best into general feeding practice if used at a tit-bit occasionally to the birds, especially when it is necessary to encourage egg production.

Buttermilk.—This is a very excellent feed for all poultry, and more especially small chickens. Unless fed *ad lib.* without water not sufficient can be digested to balance the cereal grains, and therefore half the required amount of other animal protein feed is used in the mash. It is similar to separated milk in feeding value. Dried and semi-solid buttermilk are not available as yet, but are considered one of the very best protein supplements in other countries. Be sure that buttermilk has not an excess of common salt in it before feeding.

Crayfish Meal.—A feed made from grinding the shells of crayfish it is fairly high in protein and exceptionally so in desirable mineral substances. It may be safely used as a protein supplement to the cereals where procurable at a reasonable price. It should be purchased on the value of its protein content.

Fish Meal.—A concentrated protein rich feed of high quality; is excellent for balancing the carbonaceous feeds. It is usually higher in protein than meat meal and also higher in price. It has no advantage over good meat meal. It is often not procurable and then difficulties arise.

Locust Meal.—Dried locusts ground to a meal form a very desirable protein rich feed for poultry. Wherever available it should be used in the place of other purchased protein feeds such as meat meal. Recent experiments have shown that there is no danger in utilising locusts as feed which have been killed by spraying with Government formula arsenic sprays.

Meat Meal (high grade).—Pure meat meal of high grade containing no bone, hoof, hair or other contamination is one of the best by-products of slaughter houses for use in poultry rations as a protein rich feed. It is high in protein containing the amino-acids deficient in the grains.

Meat Meal (average 50% protein).—This product is most commonly used and is the usual feed supplied when "meat

meal" is purchased. It is similar to high grade meat meal but contains more undigestible materials and less protein.

Meat and Bone Meal.—Meat meal with a varying amount of bone meal is a good feed for poultry, carrying less protein than meat meal. Meat meals generally should be purchased on the guaranteed protein content. A good sample should be free from hair and gelatinous substances and have an odour of cooked meat. Good samples are produced locally, and this feed should form the animal protein rich feed in this country as a general rule.

Meat (fresh).—Like fresh blood, meat may be used by mincing and mixing with mash to form a wet mash. Under no circumstances should putrid meat be used. It is best fed like green bone as a tit-bit, on the average size poultry farm.

Meat (dried).—When fresh meat is minced and thoroughly dried in the sun it may be used in the mash in the place of meat meal and is equally as good. It may be dried in small pieces the size of a wheat grain and fed as a scratch feed when extra protein is considered necessary. In this way meat may be preserved on the farm and made use of when needed. When cattle are dying from drought, they may be utilised in this manner. Meat from antelope, donkeys, horses, etc., is equally good, but must be fresh and free from taint.

Milk (separated).—Whole milk is seldom fed to poultry and, indeed, it is unnecessary, as separated milk is actually better, containing the same protein and less fat. Separated milk may perhaps be considered the very best protein supplement to the cereal grains. Where it is used no other minerals are required except lime. Skim milk may be fed to all classes of poultry and is especially valuable for young growing stock. To baby chicks it should be fed sour, otherwise they may be upset, or even die, from indigestion due to the fact that at first the chicks lack a lactose digesting enzyme which develops later. It should always be fed in the same condition, and because of this fact and also that it is difficult to keep sweet in summer, it is the best policy to feed it sour at all times. The sour skim milk should be thoroughly stirred before being fed as a drink or used to mix a wet mash. If desired the curds may be drained and fed in the form of

cottage cheese mixed with mash. It has been shown that sour skim milk fed *ad lib.* without water to drink, together with cracked maize, forms a balanced ration for both growing chicks and laying stock. Skim milk and butter milk may be mixed for feeding and are of equal value. They both contain Vitamins A and G.

Whey.—Milk whey is low in protein because of the loss of casein in the making of cheese. It may be used to moisten mashes but has not much feeding value.

DRY GREEN MEALS.

The dry green meals are fed as a source of Vitamin "A" and are of great importance in this country, where at times succulent green feeds are unobtainable.

Lucerne Meal.—The best samples are made from the leaves only of young lucerne stems, but the usual meal purchased is made by milling hay from the crop. The value of this feed may vary considerably according to its quality. The essentials in a good quality meal may be summarised as (1) That the meal is a good bright green colour; (2) that it contains a minimum of stems; (3) that it has not been adulterated with a poor grade of hay. Lucerne meal is high in fibre and cannot be fed in too large a quantity. It contains some lime and protein, but is chiefly fed for its Vitamin content, of which it contains all those of importance. Other legume hay meals of good green quality may be used similarly to lucerne meal.

Sunflower Leaf Meal.—The leaves of the sunflower plant if stripped at intervals, dried and ground into a meal may be used in the mash in the same way and for the same purpose as lucerne meal. It is likely that the sunflower leaf meal is equally as good a feed from the Vitamin content point of view as lucerne meal. The meal should be green and must be dried carefully out of the sun and dew to preserve the Vitamins. It contains less fibre than lucerne meal if the thick ribs of the leaves are not used. The quality of sunflower leaf meal is gauged by its green colour and freedom from thick leaf ribs and stems. It is used largely in Rhodesia in the place of lucerne meal, as the sunflower can be grown anywhere and provides other useful feeds as mentioned elsewhere.

(To be continued.)

The Objects and Value of Seed Treatment of Maize, against *Diplodia*.^{*}

By G. M. WICKENS, Ph.D. (Lond.), D.I.C.,
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Owing to the length of time that has elapsed since the publication of articles on this subject in this *Journal*, and the numerous enquiries received from farmers, it is believed that a useful purpose will be served by once again setting forth information concerning the objects and value of disinfection of maize seed.

In any commercial sample of seed, however good in general appearance, there will almost certainly be a greater or less proportion of seeds infected with *diplodia*, many of them so slightly infected as to appear even on close inspection to be free from disease. When such seed is sown, growth takes place not only of the embryo but also of the fungus. In badly infected and obviously mouldy seed, even if the embryo is not already dead, it is rapidly killed by the copious development of fungus. Less seriously affected seed, discoloured but not very greatly shrivelled, may succeed in producing a seedling above ground, but its destruction by the developing fungus will soon occur. Other seeds, infected so slightly that there is no external evidence of it, may produce a fair-sized plant, but the destruction of its roots by the fungus will so impair the nutrient-absorption capacity of the plant that it will not produce a paying cob.

The object of treating the seed is so to cover it with a fine adhesive fungicidal dust that the fungus is checked. Such treatment can not be expected entirely to inhibit growth of fungus from badly infected seed, nor bring dead seed back to life. Such seed should never be sown. But the develop-

^{*}In this article, "*Diplodia*" covers all the locally known maize seedling blight and ear-rotting fungi.

ment of the fungus from slightly infected seed can be so much retarded by this means that healthy root development is greatly increased, and what would otherwise be a weakly unproductive plant is enabled to give a fair yield.

That certain fungicidal substances, applied as a fine dusty coating to the surface of the seed, do have this effect, has been abundantly proved in a number of countries, including Rhodesia (¹). For example, in extensive field investigations in the U.S.A. (²) conducted over a period of 11 years, the better dust disinfectants increased the yield from average farmer's seed by about a bag per acre.

During the past season there has been conducted at the Salisbury Experiment Station a field experiment, designed to estimate the value of four well-known seed disinfectants which will, for reasons to be given later, be referred to simply as A, B, C, and D. The results, while not as conclusive as our experience led us to anticipate, are sufficiently interesting and suggestive to be worth recording here.

Treatment.	No. of seeds planted.	No. of "blanks" 10 days after planting.	No. of "blanks" one month after planting.	Yield of grain in lbs.
Coated with dust A ...	1,080	248	192	243.5
„ B ...	1,080	272	192	227.75
„ C ...	1,080	284	212	242.0
„ D ...	1,080	247	179	228.75
Untreated controls ...	1,080	158	146	220.5

The experiment comprised 25 plots of 1/50th acre each, 5 to each treatment, arranged in what is known as a "Latin square," so that the significance of any differences resulting from the different treatments can be statistically estimated. The sample of seed used was poor, containing a large proportion of obviously infected grain and many with seed-coats broken. Owing to heavy rains falling immediately after the treating of the seed, planting was delayed for a week after treatment.

Considering first the effect of treatment on germination, the figures indicate both retardation and reduction of germination following disinfection. Such a result is so contrary to general experience that it is necessary to seek some explanation. The following possible reasons suggest themselves.

1. Very weak plants produced by severely infected seed may be still further retarded in growth, or even killed, by the action of the fungicide.
2. Seed, or at any rate seed with broken seed-coats, may be injured by contact with the fungicide for a week before sowing.

These possibilities will be investigated, since if the latter should be true it would be better to defer seed treatment till immediately before sowing.

Coming to the figures for yield, we see that in spite of the reduced and retarded germination, the treatments gave somewhat higher yields than the controls, amounting with treatments A and C to the equivalent of an increase of more than a bag per acre. Analysing the results statistically, it is found that the odds in favour of this increase being due to treatment rather than chance are about 30 to 1, which may be considered to be just significant. The increases of yield from treatments B and D are not significant, and taking the results as a whole the level of significance is not sufficiently high to warrant discrimination between the dusts as to their effectiveness. For this reason it is considered inadvisable to give their names.

To summarize: while as a whole the results are not as conclusively in favour of seed treatment as was anticipated (but it must be remembered that the seed sample was poor), it is considered that they do quite definitely indicate that (especially with normal sample of seed), seed disinfection will give an appreciable increase of yield. A more extensive and accurate experiment is planned for the coming season.

In conclusion it will be well, in order to remove widely-held misconceptions, to explain what seed treatment will and will not do. It *will* produce a better stand of healthy productive plants, thus giving an increased yield, but will *not*

prevent the infection of cobs. Mouldy cobs are caused *not* by internal growth of the fungus up the stem, but by air-carried spores which are produced in countless invisible millions from infected trash left lying in or near the lands. Only by burning all rubbish left over after feeding the cattle can the porportion of mouldy cobs be reduced. As a further incentive to farmers to burn the rubbish it may be mentioned that experimental dressings of maize trash have not increased the productivity of the land⁽³⁾, and that a number of farmers have found in practice that burning the rubbish has appreciably reduced cob infection.

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Forestry in Southern Rhodesia.

Statement prepared by E. J. KELLY-EDWARDS, Chief Forest Officer, Southern Rhodesia, for the Fourth Empire Forestry Conference held in the Union of South Africa, September-October, 1935.

The following statement is the first to be compiled since the initial Statement prepared by J. S. Henkel, late Chief Forest Officer, for the first Empire Forestry Conference in 1920.

The present Statement records the progress made during the years 1920 to 1933.

PART 1.

GENERAL DESCRIPTION OF THE COUNTRY.

The following amendments or additions to the 1920 Statement are necessary:—

Area.—The area of Southern Rhodesia is estimated to be 150,354 square miles, or 96,226,560 acres.

Climate.—**Winds.**—Available observations show that wind velocities are generally highest between 6 a.m. and noon throughout the year, and the highest velocities are recorded in September and October. As this period marks the end of the dry season, and as these months are given to high temperatures, vegetation is at this time most liable to damage from fires. The general wind direction, which is fairly uniform over the whole country, varies from south-easterly in the winter (dry) months to north-easterly during the rainy season.

Frost.—Is liable to occur on the ground during the period May to August over the greater part of the country. It is often very severe. Air drainage has an important bearing, for areas in valleys having narrow openings to lower-lying land frequently are “frost hollows.” Such areas are sometimes of considerable extent. Some of the plateau grasslands

owe their origin to the combined effect of frost and water-logging. It is a common sight to see the annual frost injury to tree growth where it attempts to invade the "vleis"—grassland depressions. Occasionally severe frosts, occurring as late as September or even October, injure and completely defoliate large trees. Both in the Zambesi and Limpopo Valleys there is a frost line, which, in a general way, is indicated by the palm *Hyphæne ventricosa* and the boundary of the main *Copaifera mopane* areas.

Hail.—Is liable to occur, particularly in the early part of the rainy season, and a certain amount of damage to agricultural crops may be sustained. The areas affected are usually very local, and there is no record of storms of major intensity such as those which occasionally sweep over parts of the Union of South Africa.

PART 2.

DESCRIPTION OF MAIN TYPES OF FOREST GROWTH.

The types mentioned in the 1920 Statement have been further sub-divided as follows:—

A.—CLOSED FOREST.

(i.) **Mountain Forests.**—These forests are found in the mountains which form the Eastern border of the Colony, where temperatures are cool and mists and high rainfall occur. They occupy valleys and slopes and occasionally spread therefrom and crown high ridges. The forests usually have sharply defined margins which merge abruptly into mountain grassland. Transition shrubs, such as *Myrica* sp., *Hypericum* sp. and *Philippia* sp., in places occupy a narrow zone shaded by marginal trees.

The mountain forests are an evergreen association usually with four or more strata. The general appearance is similar to the mist-belt closed forests of the Union of South Africa, with some of the of the same species present as dominants and sub-dominants.

Edaphic conditions, aspect, slope, as well as altitude, play their part and cause differentiation. At the higher altitudes yellow-wood (*Podocarpus milanjanus*) and cedar (*Wid-*

dringtonia whytei) associated with *Philippia simii*, *Leucosidea sericea* and other shrubs are found. In the upper portions of valleys and rocky wet slopes *Strelitzia angusta* is sometimes abundant as a marginal plant to the forests consisting of *Cussonia umbellifera*, *Aphloia theaeformis*, *Curtisea faginea*, *Conopharyngia stapfiana*, *Croton sylvaticus*, *Eugenia cordata*, *Eugenia gerrardi*, *Chrysophyllum fulvum*, *Pygeum africanum*, *Ficus capensis*, *Macaranga mellifera*, *Bridelia atroviridis*, *Maesa lanceolata*, *Ilex mitis*, *Xymalos monospora*, *Albizzia chirindensis*, *Rapanea umbratilis*, etc.

At lower altitudes, but still in the zone of high rainfall, the forests contain such dominant trees as *Khaya niasica*, *Trichilia chirindensis*, *Lovoa swynnertonii*, *Maba mualala*, *Gardenia tigrina*, *Tannodia swynnertonii*, *Ehretia divaricata*, *Strychnos mitis*, *Craibea gazensis* associated with *Bosquiea phoberos*, *Chrysophyllum fulvum*, *Rauwolfia inebrians*, *Myrianthus arboreus*, *Celtis dioica*, *Piptadenia buchanani*, *Ekebergia meyeri*, *Kiggelaria africana*, *Pittosporum viridiflorum*, *Teclea swynnertonii*, *Teclea natalensis*, *Pygeum africanum*, etc. Parasitic figs are abundant, and under the tall forest trees there is a growth of shade bearing trees and shrubs, with clumps of *Dracaena fragrans* and *Dracaena gazensis*. The floor is occupied by a carpet of mosses and ferns. Various lianes, notably *Oncinotis chirindica*, are abundant and climb to the tops of the highest trees. Mosses, orchids and epiphytic ferns are abundant on the larger trees.

At still lower altitudes, notably on the slopes to and also within Portuguese territory, the types become confined to the stream banks, and *Anthocleista zambesiaca* and *Adina microcephala* appear as dominant trees. In some of the kloofs *Piptadenia buchanani* attains great height. So-called second-growth forest is sparingly present. At the Stapleford Forest Reserve, on the mountain slopes, there are some such forest patches that contain second-growth. Leading to these forest patches are ancient roads. On the whole, the present closed forest area appears to be that which has been in existence for a long period of time. In some few localities ancient terraces have been invaded by forests, and the old "pit" ruins usually have forest trees growing in them.

(ii.) **Fringing Forest.**—In the tree-veld (Savannah) zones belts of evergreen closed forest occur along perennial water courses or old river beds supplied with flood water during the rainy season. To maintain these fringing forests an abundant water supply throughout the year is essential. The species occurring in the stream-bank forests vary with the climatic zones. On the high and middle veld the following are commonly noted:—

Syzygium cordatum, *Eugenia owariensis*, *Eugenia* sp., *Chrysophyllum argyrophyllum*, *Mimusops kirkii*, *Combretum* spp., *Rauwolfia inebrians*, *Ilex mitis*, *Myrica aethiopica*, *Trichilia emetica*, *Ekebergia meyeri*, *Pittosporum viridiflorum*, *Diospyros mespiliformis*, *Celtis dioica*, *Acacia campylacantha*. In the Tlomagundi district *Khaya nyasica* is met with as a stream-bank tree.

Syzygium cordatum frequently forms small thickets round springs and streams on the main plateau and along escarpments.

Such deciduous tree-veld trees as *Lonchocarpus capassa*, *Kigelia pinnata*, *Acacia campylacantha*, *Pterocarpus sericeus*, *Acacia* spp., *Burkea africana*, *Terminalia sericea*, *Bauhinia articulata*, *Strychnos* sp., and *Diospyros mespiliformis* are often, but not always, found on alluvial soils near river banks or in moist localities such as seepage zones. Where they are in touch with permanent water they are more closely spaced, reach large dimensions and may be deciduous for only a short period. *Phoenix reclinata*, the wild date, is often found on stream banks, sometimes pure, sometimes in association with fringing forest.

In the low veld the following species may occur in stream-bank forests:—*Acacia albida*, *Acacia campylacantha*, *Eugenia* spp., *Diospyros mespiliformis*, *Trichilia emetica*, *Khaya nyasica*, *Kigelia pinnata*, *Lonchocarpus capassa*, *Garcinia livingstonei*, *Cordyla africana*, *Tamarindus indica* and *Adina galpini*.

The fringing forests usually have an under-storey of small trees and shrubs. Their dense shade limits evaporation, and their roots and stems prevent soil erosion and hold up and break the force of flood water.

Where fringing forests do not occur along the banks of perennial watercourses, species of *Salix* and *Rhus*, associated with the common reed, *Phragmites communis*, are often to be found.

B.—OPEN FORESTS (TREE-VELD).

The term "tree-veld," suggested by Bews, is expressive and exactly conveys what is meant, namely, trees mixed with grass. This is the type which covers the greater part of the Colony. With data at present available it is possible to subdivide the tree-veld by means of physiognomic characters into eight main associations, and to distinguish these associations by the name of the tree which is clearly most in evidence. The native names have been selected, with the exception of one group—the *Acacias*—a type generally so well known that the expressive term "thorn-veld" has been used.

In describing the units, the uppermost in altitude has been taken first, namely, muhatja (*Parinarium mobola*), and this is followed by the other units met with at decreasing elevations, mopani (*Copaifera mopane*) being the lowest.

Type 1 (a). Muhatja (*Parinarium mobola*).—The higher part of the main plateau in the eastern half of the Colony is characterised by the presence of the muhatja tree. This large tree is evergreen, with a straight bole and large spreading, rounded crown. Usually the trees are widely spaced, but sometimes they are in clumps or belts, with spacing so close as to give the appearance of a closed forest. On account of the dense shade cast by the tree, grass within the influence of the shade is replaced by a shade-bearing herbage. Associated with this tree in typical localities are *Protea abyssinica*, *Protea angolensis*, *Faurea speciosa* and *Faurea saligna* and an abundance of grass. The two *Faureas* are usually not found together. *Faurea speciosa* is much more common and attains to larger dimensions in the northern parts of the high veld than the southern. *Protea abyssinica* is much more common than *Protea angolensis*. The association is typical tree-veld and the type appears at one time to have covered the whole of the Southern Rhodesian plateau.

The type has been extensively invaded by other types, notably by msasa (*Brachystegia randii*) and ungusu (*Baikia plurijuga*). In many places its former extensive limits may be noted by a few large muhatja trees, now rapidly disappearing. *Protea abyssinica* is found as a fringing belt along "vleis" throughout the Colony.

As associates or invaders the following species are frequently noted:—*Monotes glaber*, *Cussonia spicata*, *Erythrina tomentosa*, *Strychnos spinosa*, *Vangueria infausta*, *Isoberlinea globiflora*, *Uapaca kirkiana*, *Uapaca nitida*, etc. *Eugenia ovariensis* frequently fringes the type where it adjoins "vleis."

A group in many respects very striking in its character is that of the Mountain Acacia (*Brachystegia tamarindoides* or *filiformis*). This tree occurs on rocky "kopjes" and stony places throughout the eastern and middle portions of the Colony. It occurs on many of the highest "kopjes" and descends to low elevations. It is generally gregarious, but on the edges of the "kopjes" it merges into the associates of the zone in which the "kopjes" occur. It is possible that this tree is one of the earliest invaders, and competition has forced it to occupy areas of shallow rocky soil where other species cannot thrive.

Type 1 (b). Mangwe (*Terminalia sericea*).—The altitude and geological formation of the main plateau which extends from Plumtree to beyond Salisbury show no striking differences between the south-western and north-eastern extremities. The rainfall, however, in the south-west is only 20 to 25 inches, as against 30 to 40 inches in the north-east. On account of this lower rainfall in the south-west other species become dominant. In this lower rainfall zone, on the granites and gneisses, which generally give rise to acid soils, the mangwe (*Terminalia sericea*) is dominant.

The type is very mixed, but the mukarati (*Burkea africana*) is nearly always found in association with, and in some localities it may be more abundant than, the mangwe. Associates of these two trees are the following:—*Peltophorum africanum*, *Sclerocarya caffra*, *Rhus lancea*, *Rhus viminalis*, *Bauhinia articulata*, *Protea abyssinica*, *Faurea saligna*,

Dombeya rotundifolia, *Bolusanthus speciosus*, *Lannea discolor*, *Heeria insignis*, *Combretum rhodesicum*, *Combretum* spp., *Albizzia amara*, *Ficus capensis*, *Vitex* sp., *Combretum petersii*, *Pseudolachnostylis maprouneæfolia*, *Zizyphus mucronata*, *Pterocarpus sericeus*, *Commiphora* spp., *Acacia* spp., *Kirkia acuminata*, *Pterocarpus angolensis*. The shrubs *Euclea lanceolata*, *Carissa tomentosa*, *Ormocarpum trichocarpum*, *Tarchonanthus camphoratus*, *Gymnosporia buxifolia* become more evident. In poorly drained areas mopani (*Copaifera mopane*) is frequent.

Type 1 (c). Thorn-veld (*Acacia* spp.).—In the lower rainfall areas of the south-western and middle portions of the main plateau, on the alkaline soils of the basement schists, various species of *Acacia* become dominant. This association is best developed in the neighbourhood of Bulawayo and along the road to the Matopo Park. The *Acacia* association is characterised by shallow soils, and occurs as an interrupted belt of varying thickness extending from the western boundary of the Colony to the Charter district. Frequently met with in this belt are:—*Acacia benthami*, *Acacia karroo*, *Acacia mimosoides*, *Acacia rehmanniana*, *Acacia seyal*, *Acacia vereke*, *Dichrostachys nutans*, *Albizzia amara*, *Bolusanthus speciosus*, *Rhus lancea*, *Sclerocarya caffra*, *Peltophorum africanum*, *Zizyphus mucronata*, *Combretum* spp., *Heeria insignis*, etc. The shrubs *Euclea lanceolata* and *Carissa tomentosa* are abundant within the type.

The typical thorn-veld trees are not as tall as those in other types, except in certain areas of the Kalahari sands in the north-west of the Colony, where the camelthorn (*Acacia giraffæ*) is dominant as a large tree. In these areas dense thickets (sinangas) consisting of *Dichrostachys* and other species are abundant. *Acacias* of various species are frequently found on the black vlei soils throughout the Colony.

Type 2. Mahobohobo (*Uapaca kirkiana*).—The mahobohobo or muzhanzhi is widely distributed in the eastern half of the Colony, and occupies a zone next to the muhatja. It is found at its best in situations which are well watered and well drained, such as ridges at heads of valleys having eastern and southern aspects. It is sensitive to frost, and the areas occupied by it are always frost-free. It is best developed

on red, rocky soils, but frequently occurs on soils of granite origin. Mahobohobo is met with in pure forests almost close-type in character, with poor grass growth on the floor. It is semi-evergreen, evergreen in normally wet years and deciduous in years of low rainfall. Away from its optima conditions the tree appears on the eastern and southern slopes of kopjes as clumps or single trees associated with other species. On account of the abundant humus produced by the tree, natives are partial to the association, and considerable areas have been deforested. The tree is vigorous, persistent and somewhat aggressive, and can ordinarily hold out against competitors.

In the same localities occupied by the mahobohobo the smaller species, *Uapaca nitida*, often occurs as an isolated tree.

In the colluvial soils at the base of rocky hills occupied by mountain acacia (*Brachystegia tamarindoides*) belts of mahobohobo are nearly always found.

Type 3 (a). Msasa (*Brachystegia randii*).—This type covers a large area widely spread in the eastern portions of the Colony. Its best development is within the 30 to 40-inch rainfall zone. Msasa is frequently associated with the mmondo (*Isobertia globiflora*). Sometimes the one, sometimes the other dominates, and not infrequently the one or the other occurs in pure stands. Both are aggressive, and the tendency is to kill all competitors. Of the two trees, the mmondo has the wider range upwards and downwards from its optimum. The type appears to be of north-eastern origin, and like two arms has spread up the middle and high veld on both sides of the main divide. South of the divide they thin out towards the south-west, but reach the Gwanda district. On the north side of the divide they reach the border of the Colony beyond Victoria Falls. These trees only occur on well-drained soils. Where moisture and temperature conditions are unfavourable—either soil or air—they assume scrub form, and, with increasing elevation, disappear, persisting, however, on western aspects. In optima conditions the trees attain heights of 60 feet, with long, straight cylindrical boles up to 3 feet in diameter. The mmondo, however, never attains the dimensions of the msasa. These two trees are invading the upper groups.

Species associated with this type are:—*Parinarium mobola*, *Faurea saligna*, *Faurea speciosa*, *Peltophorum africanum*, *Bolusanthus speciosus*, *Pterocarpus angolensis*, *Monotes glaber*, *M. hypoleucus* and *M. africanus*, *Strychnos* spp., *Swartzia madagascariensis*, *Burkea africana*, *Terminalia sericea*, *Terminalia robusta*, *Albizzia* spp., *Uapaca kirkiana*, *Ochna* spp., *Acacia* spp., etc.

Where the type adjoins vleis it is frequently fringed by *Protea* spp., *Bauhinia articulata*, *Terminalia sericea*, *Combretum* spp., *Lonchocarpus capassa*, *Kigelia pinnata*, *Eugenia owariensis*, *Securidaca longipedunculata* and *Acacia* spp. *Parinarium* and *Eugenia owariensis* frequently occur on the edges of vleis as a low scrub only a foot or more in height.

Type 3 (b). Umgusu (*Baikitea plurijuga*).—This type, though on a lower level and less well-watered, may be considered the north-western equivalent of the msasa (mahobohobo is absent in the north-west). The type is exclusively confined to the Kalahari sand formation. The chief associate of the umgusu is the umtjibi or Rhodesian mahogany (*Copaiifera coleosperma*).

A careful study of the vegetation indicates that at one time the sand areas were covered by the *Parinarium-Protea* type; this type was replaced by umgusu and umtjibi, two trees apparently of north-western origin, and were at one time co-extensive with the whole present distribution of the Kalahari system, except the outliers in the Gwelo and Chilizanazi districts.

The present type is being displaced by *Brachystegia randii*, *Isobertia globiflora* and *Brachystegia woodiana*. The line of advance of these species can easily be determined when traversing the sand areas.

In typical form umgusu is associated with:—*Pterocarpus angolensis*, *Erythrophloeum africanum*, *Riciodendron rautanenii*, *Maba mualala*, *Dialium simii*, *Ochna pulchra*, *Terminalia sericea*, *Combretum* spp., *Burkea africana*; in the northern portions *Azelia cuanzensis*, *Kirkia acuminata*, *Diospyros* spp., *Acacia giraffæ*, *Amblygonocarpus obtusan-*

gulus. In the vleis scattered through the areas are large trees of *Diospyros mespiliformis* and *Combretum petersii*; these, however, usually occur on termite mounds.

Type 4. Mfuti (*Brachystegia woodiana*).—The mfuti or umtjabele type occupies a warmer and drier zone than the msasa. The type is widespread on the middle veld. It borders the low veld on both sides of the main plateau. The mfuti is perhaps the most widely distributed of the *Brachystegias* and has a fairly wide altitudinal range. The tree is intolerant, vigorous, coppices freely, is extremely hardy, and in dry situations remains leafless until sufficient rain has fallen to supply water to flush it into leaf. Its associates are trees that occupy dry situations. In the north-west parts of the Colony, on shallow soils, the mfuti is replaced by *Kirkia acuminata*. Trees frequently associated with the type are:—*Diospyros mespiliformis* (on termite mounds, notably in the Hartley district), *Azelia cuanzensis*, *Afrormosia angolensis*, *Peltophorum africanum*, *Kirkia acuminata*, *Acacia nigrescens*, *Acacia* spp., *Sclerocarya caffra*, *Dichrostachys nutans*, *Pterocarpus* spp., *Copaifera mopane*, *Terminalia robusta*, *Terminalia sericea*. The tree, as with other *Brachystegias*, avoids ill-drained areas which are either covered with grass or occupied by *Copaifera mopane*. In the north-eastern parts of the Colony the muturu (*Brachystegia utilis*) is a common associate near the boundary of the mopani veld. Margins of vleis in the *Brachystegia woodiana* zone are occupied by *Combretum* spp., *Terminalia* spp., *Securidaca longipedunculata*, *Lonchocarpus capassa*, *Kigelia pinnata*, *Acacia campylacantha*, *Acacia* spp., etc.

Type 5. Mopani (*Copaifera mopane*).—Mopani occurs in nearly pure forest over extensive areas. Unlike the *Brachystegias*, the mopani is capable of living in low-lying land alternately very wet or very dry. In the low veld it occupies places which in similar situations on the high veld carry grass. Frequently mopani forests have very thin, poorly developed grass, or there may be large areas quite bare of grass with aloes only as an under-storey. In the south-eastern low veld, which enjoys a higher rainfall, the mopani extends northward only to the foothills and westward up the Limpopo valley (where conditions become drier) to the watershed at Plum-tree, where it is found associated with *Proteas*.

In the low veld of the Zambesi valley mopani also covers extensive areas, but on the drier western slopes of the main divide it is frequently found on the high veld almost to the main watershed.

Mopani is an aggressive tree and tends to oust competitors. Its associates are chiefly found in the better drained areas. In typical low veld a characteristic associate is the Baobab (*Adansonia digitata*). On the higher parts of the eastern low veld it mixes with mfuti and mnondo. Other trees commonly found in the low veld are:—*Kirkia acuminata*, *Sterculia* spp., *Afzelia cuanzensis*, *Sclerocarya caffra*, *Combretum petersii*, *Terminalia prunoides*, *Acacia nigrescens* or *pallens*, *Acacia litakunensis*, *Pterocarpus sericeus*, *Pterocarpus* spp., *Isobertia globiflora*, *Commiphora* spp., *Spirostachys africana* (Limpopo and Lundi valleys), *Euphorbia* spp., *Diospyros mespiliformis* (along water-courses and on termite mounds), *Bauhinia articulata*, *Combretum* spp., *Kigelia pinnata*, *Lonchocarpus capassa*, etc.

In the eastern parts of the Sabi and Lundi valleys the hills and ridges which intersect the low veld are covered with *Androstachys johnsoni* mixed with an unnamed species of *Brachystegia*.

In the Zambesi valley a zone more or less parallel to the river is occupied by a long belt of *Copaifera gorskiana*. This belt extends from the neighbourhood of Wankie for at least 100 miles in a north-easterly direction.

PART 3.

AREA AND CONTENTS OF EXISTING FORESTS.

A.—AREA.

It is estimated that the Colony is wooded to the extent of approximately 60% of its entire area. Table I. is arrived at partly from statistics available, but mainly from applying the arbitrary proportion above mentioned. "Merchantable areas" are based on land lying approximately within 20 miles of railways, and include this 60% factor. "Conifers" are made up entirely of plantations of exotic trees, as the area and quantity of indigenous conifers are negligible.

Table I.—Area.
(In square miles).

	Merchant- able.	FOREST. Unprofit- able or Inaccessible.	Total.	Agri- cultural Land.	Other Land.	Total Land.
	(1)	(2)	(3)	(4)	(5)	(6)
Conifers .	4	5	9	3,100	58,445	—
Broad- leaved	22,200	66,600	88,800	—	—	—
Total . . .	22,204	66,605	88,809	3,100	58,445	150,354
Forest area as percentage of total land area	14.8	44.2	59.0	2.1	38.9	100%

B.—VOLUME OF STANDING TIMBER.

Table I.A is arrived at by computing the areas of the various forest types from a map showing the distribution of the types, and by applying to each type an estimated average volume per unit of area. The volume of broadleaved merchantable timber includes approximately 11 square miles carrying an estimated volume of 11,264,00 cubic feet of exotic planted timber.

Table I.A.—Volume of Standing Timber.

	Merchantable.		Unprofitable or Inaccessible.		Total.
	Per sq. mile.	Total.	Per sq. mile.	Total.	Total.
	(1)	(2)	(3)	(4)	(5)
	cu. ft.	Million cu. ft.	cu. ft.	Million cu. ft.	Million cu. ft.
Conifers . . .	480,000	1.92	—	—	1.92
Broadleaved	110,250	2,447.88	93,600	6,234.55	8,682.43
Total	—	2,449.80	—	6,234.55	8,684.35

(To be continued.)

Domestic Water Supplies and Sanitation on the Farm.

By P. H. HAVILAND, B.Sc. (Eng.), A.M.I.C.E.,
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(Continued.)

PIPE DISCHARGES. Gallons per minute.

Pipe line grade.	Inside diameter of pipe in inches.										
	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	5
1 in 100	$\frac{3}{4}$	2	$3\frac{1}{2}$	$5\frac{3}{4}$	$8\frac{1}{2}$	12	$22\frac{1}{2}$	36	54	80	145
„ 200	...	$1\frac{1}{4}$	$2\frac{1}{4}$	$3\frac{3}{4}$	$5\frac{3}{4}$	8	15	24	37	54	100
„ 300	...	1	$1\frac{3}{4}$	3	$4\frac{1}{2}$	$6\frac{1}{4}$	12	19	29	42	80
„ 500	...	$\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{1}{4}$	$3\frac{1}{4}$	$4\frac{3}{4}$	9	$14\frac{1}{2}$	22	32	58
„ 700	1	$1\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{3}{4}$	$7\frac{1}{2}$	12	18	26	48
„ 1,000	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	3	6	$9\frac{1}{2}$	$14\frac{1}{2}$	21	39
„ 1,500	$1\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{1}{2}$	$4\frac{3}{4}$	$7\frac{1}{2}$	12	17	31
„ 2,000	1	$1\frac{1}{2}$	2	4	$6\frac{1}{2}$	10	14	26
„ 3,000	$\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$3\frac{1}{4}$	5	$7\frac{3}{4}$	11	21

An example will show how use may be made of the tables:—Total requirements in 24 hours are 2,100 gallons, which is approximately $1\frac{1}{2}$ gallons per minute. The difference in elevation between the inlet and outlet of the pipe line is $2\frac{1}{2}$ feet, and the total length of the pipe line is 5,000 feet. The grade will therefore be 1 in $\frac{5,000}{2\frac{1}{2}} = 1$ in 2,000.

Following the 1 in 2,000 grade line in the table as far as $1\frac{1}{2}$ gallons per minute discharge, and then going to the top of the column in which the $1\frac{1}{2}$ appears, it is found that the diameter of the pipe required is $1\frac{3}{4}$ inches.

Another example of the use of the tables:—A line of $2\frac{1}{2}$ inch diameter piping has been laid on a grade of 1 in 400; how much water will be discharged in 12 hours? The grade of 1 in 400 lies between 1 in 300 and 1 in 500. Follow along the 1 in 300 grade line as far as the $2\frac{1}{2}$ inch diameter column, and the discharge is given as 12 gallons per minute. Similarly a grade of 1 in 500 gives a discharge of 9 gallons per minute. A grade of 1 in 400 will give a discharge approximately between 9 and 12, that is $10\frac{1}{2}$ gallons per minute. The discharge in 12 hours will therefore be $10\frac{1}{2}$ multiplied by 60 multiplied by 12=7,560 gallons.

Pumping Schemes.—Owing to the depth of most water supplies in this country pumping usually has to be resorted to, and in this connection the chief factor to be considered is the most economical and efficient prime mover or engine to instal. Power may be obtained from water, wind, steam or the expansion of gases, and various kinds of engines are employed which make use of these.

Horse Power.—The power necessary to perform the work required must be found before any particular type of engine can be decided on.

A horse power is a unit of measure of the energy expended in doing a definite amount of work. One horse power is defined as 33,000 foot-pounds of work per minute. This may be explained as the energy required to raise 33,000 pounds through a height of 1 foot in 1 minute.

The same amount of energy would be expended in raising 33 pounds to a height of 1,000 feet in 1 minute, or in raising 33 pounds to a height of 100 feet in 1—10th of a minute.

In makers' catalogues the terms Indicated Horse Power (I.H.P.), Nominal Horse Power (N.H.P.), and Brake Horse Power (B.H.P.) often appear, and an explanation of these terms will be useful.

Indicated Horse Power is the theoretical horse power, and includes that necessary to drive the engine itself. Nominal Horse Power is, as its name implies, merely nominal, and is less than Brake Horse Power, very often being about a half to a third for portable steam engines. Brake Horse Power is the actual power available at the engine for driving other machinery.

When any machinery is driven a certain amount of work has to be performed in overcoming the frictional resistance in the moving parts of the machine, and the frictional resistance to be overcome controls the efficiency of any plant. Pumping plants, consisting of the prime mover or engine and machinery such as pumps, have efficiencies varying from 25 to 75 per cent., which means that the actual or brake horse power required in the prime mover will have to be considerably greater than the theoretical power required to raise water. An average efficiency of 40 per cent. may be assumed for purposes of calculation. The following formula may be used to find the horse power necessary for raising water:—

Brake horse power = $\frac{Q \times H}{79,200}$ where Q is the number of gallons of water pumped per hour and H is the height in feet the water is raised. H is measured from the lowest water level from which pumping takes place up to the highest point of delivery.

The formula may be expressed thus: Multiply gallons per hour by height in feet and divide the result by 79,200.

The approximate brake horse power having been ascertained in this way, the type of engine may be decided upon. If it is proposed to use a pumping plant for domestic water supplies and for irrigation, it should be noted that a 3-inch watering on an acre, which is the usual amount of water applied at any one time, amounts to 60,000 gallons.

Water Power.—The most economic machine to instal and run is the hydraulic ram. A general description of rams and the method in which they operate appeared in the *Rhodesia Agricultural Journal* of February, 1920, and is also available in bulletin form. Rams of different sizes will operate with

large ranges of flows varying from $1\frac{1}{2}$ gallons to 1,800 gallons per minute, and with working falls from $1\frac{1}{2}$ to 100 feet, although it is not advisable to make use of working falls of much over 20 feet, owing to the wear and tear of the valves. In general the efficiency of a ram varies as the ratio of the lift to the working fall varies. The percentage lifted of water supplied to the ram is shown in the table below.*

TABLE.

	H	3	5	8	10	15	20
Ratio of lift to fall	h	1	1	1	1	1	1
Efficiency, per cent.... ..	...	77	67	55	48	34	22
Percentage lifted of water supplied to ram ... ..	...	25	13	6	5	2	1

If H is the height to which the water is raised above the ram, and h is the working fall, the ratio referred to above will be $\frac{H}{h}$. Suppose the lift were 56 feet and the working fall

7 feet, the ratio would be $\frac{56}{7}$ or $\frac{8}{1}$ and the efficiency would be 55 per cent. and the percentage lifted of water supplied would be about 6 per cent. That is, for every 100 gallons used to operate the ram, 6 gallons would be raised to a height of 56 feet.

The maintenance costs of a ram are negligible, and an occasional overhaul is all that is necessary. Attendance is not required and the ram will operate day and night. A ram will not operate under water, however, and consequently, in investigating the working fall available, due regard must be had to the maximum flood levels in streams in order that operation may continue as long as possible. A ram is started

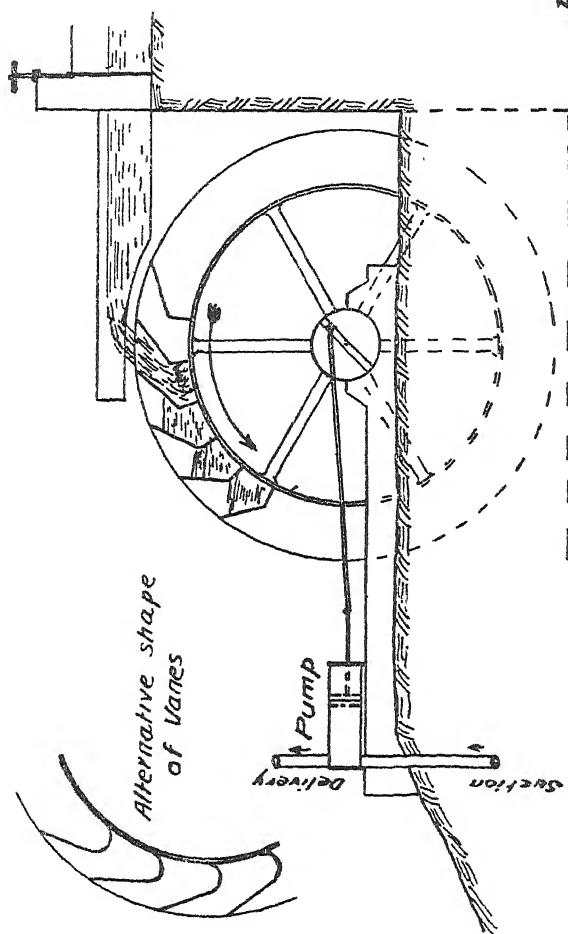
*S.A. Journal of Industries, p. 136, February, 1919.

and stopped by opening and shutting off the supply water. Good foundations are necessary for rams. The drive or operating pipe is usually of a length equivalent to seven times the working fall. Water may be conveyed in an open canal as far as the drive pipe. One type of ram now on the market will raise clean water from one source while it is operated by dirty water from another source.

Other water-operated machines are water wheels and turbines. The difference between a water wheel and a turbine is that in the former water is admitted to the wheel at one point only at any one time, and in the latter water is admitted simultaneously to all points on its circumference.

There are four types of water wheels—overshot, undershot, breast and Pelton wheels. In general, water wheels, except the Pelton, are suitable only for small powers and low heads or falls and where close speed regulation is not necessary. The water wheel is of great size and weight and has a low rotative speed. Consequently, if machinery has to be driven at high speeds it necessitates the use of large gears with resulting increase in friction. Against these disadvantages there are the comparatively low cost of the wheel, cheap repairs, inexpensive housing and simple construction. For pumping purposes, however, a water wheel can be used as shown in Figure VI. In the overshot wheel, water is supplied near the highest point of the circumference to a series of buckets round the circumference. The buckets are formed by vanes between two circular shrouds, the bottoms of the buckets being formed by the inside circumference of the wheel. Figure VI. shows the general arrangement. Two types of vanes are shown—angular and curved. The curved type gives a greater efficiency, but is a little more expensive to construct. In the undershot and breast wheel, water is supplied at the lowest and at some point in the breast respectively.

The Pelton wheel is suitable for small flows and big falls and will prove very economical for a combination of pumping and generation of electric power, the latter being used for the supply of light and the operation of agricultural machinery. The Pelton wheel is capable of high rotative speed, and great speed variation is possible with very little loss of efficiency. A Pelton wheel is not recommended for falls of less than 30

*Fig. VI.*

feet. For falls above 50 feet the Pelton wheel cannot be surpassed in efficiency by any other form of hydraulic motor.

The horse power obtainable from falling water is given approximately by the formula $\frac{q \times h}{4,500}$ where q is the quantity of operating water in gallons per minute and h is the available fall measured down to the level where the water leaves the wheel.

Turbines as a rule are too expensive to be utilised for pumping purposes and will not be discussed.

Wind Power.—A windmill will be found to be a most satisfactory power unit for small water supplies where wind is fairly regular and when the pumping lift is not too great. The running costs are negligible, consisting only of a small quantity of lubricating oil and the expense of an occasional overhaul. Many makes of windmills are on the market, and the majority of these are very satisfactory. The enclosed oil bath type of mill is probably the best, as when once filled with oil it is capable of running for a considerable period without attention. It is, however, not advisable to leave the inspection of a windmill for too long a period. Windmills are usually stocked in sizes varying from eight feet to sixteen feet diameter. The correct size to adopt depends on the total lift necessary. This total lift is measured from the lowest water level to the highest point of delivery, the latter being usually a tank of reservoir.

The following table* gives maximum lifts suitable for different sizes of mill:—

Diameter of mill.	Total lift.
8 feet	106
10 feet	158
12 feet	250
14 feet	375
16 feet	450

When maximum lifts are used the cylinder should not be greater than 2-inch diameter, but where the lift is less the cylinder may be correspondingly greater, thus enabling a

*Stewarts & Lloyds (South Africa), Ltd.

larger quantity of water to be delivered. As an example, a 10-foot diameter windmill with a 2-inch cylinder and a lift of 158 feet is capable of delivering 109 gallons per hour in a light wind and 163 gallons in a wind of 15 miles per hour. The same mill, with a lift of 74 feet and a 3-inch cylinder, will deliver under the above wind conditions 248 and 372 gallons per hour respectively.*

Commercial firms who supply windmills will always give details as to the most suitable size of mill and cylinder to instal in any particular case.

In investigating the installation of a windmill, the height of tower must be considered. The height is controlled by trees, buildings and other wind-diverting obstacles in the immediate vicinity. The tower should be sufficiently high to clear any obstacles which are within 400 feet of it. The velocity of wind depends on the frictional resistance opposing the movement, and as an increase in wind velocity gives increased power, it will be found better to instal a small wheel on a high tower in preference to a larger wheel on a low tower.

A point to be borne in mind in considering windmills is that wind is intermittent in occurrence and as a general rule can be relied upon for only one-third of the time. It will therefore be necessary to provide storage for, say, a three-days' supply—or better, storage sufficient to take four to seven days' windmill delivery. If daily requirements are 800 gallons, storage should be provided for at least a three days' supply of 2,400 gallons, and the pumping rate to be allowed for should be 100 gallons per hour.

Animal Power.—Animal power may be made use of by means of the "Noria" or "Bakkies" pump, which consists of an endless revolving chain of buckets operated through gearing, but it is not a very satisfactory method of raising water, and can be used only for lifts not exceeding 10 feet.

A more satisfactory way is to instal a piston pump operated by some form of animal operated gear, such as is shown in Figure VII.* The cost of such a gear is approxi-

*By permission of Messrs. Stewarts and Lloyds (South Africa) Ltd.

mately £70, f.o.r. Salisbury. This type of gear can very conveniently be installed in localities where small supplies are required and where wind conditions are unfavourable for the use of the windmills. This gear will raise about 550 gallons per hour against a head of 50 to 60 feet, and 350 gallons per hour against a head of 90 to 100 feet, the number of strokes per minute being 25.

Steam Engines.—Small steam plants, although comparatively inexpensive in first cost and maintenance, are usually costly to run. The conditions which go to make pumping by steam economical are a plentiful and convenient supply of good wood and the use of the engine, which must be of the portable type, for other work on the farm. Should fuel have to be purchased, pumping by a steam engine will be found expensive. The costs of running are made up of continual attendance, loss of time in raising steam, fuel and lubrication. Great care must be taken to keep the boiler clean, and water containing a high percentage of mineral salts should be avoided.

Internal Combustion Engines.—The most suitable types of internal combustion engines to use for water supplies on the farm are the suction gas, crude oil and petrol-paraffin engines. For small sizes up to 3 h.p. the petrol paraffin engines must be used, but as crude oil engines are now manufactured in all sizes from 3 h.p. upwards and are more economical to operate, they are now usually installed instead of the petrol paraffin engine. The consumption of crude oil in the small sizes is under $\frac{3}{4}$ pint per brake horse power per hour as compared with one pint of paraffin per brake horse power per hour in the ordinary oil engine and for the larger sizes the consumption is somewhat less. These engines are obtainable as portable on wheels, semi-portable on skids and stationary, and are suitable for driving any agricultural machinery. They require very little attendance once started, and are fairly simple in design. The cost of fuel prevents the larger sizes being used economically.

For large sizes a suction gas plant will probably be the cheapest to run. These are fairly high in cost per horse power for small sizes, but this cost per horse power is reduced considerably as the size of engine increases. Suction gas is a

very efficient fuel, and the producer installed may be either of the charcoal or refuse-burning type. The former is more suitable for small plants, the latter being installed for engine sizes of about 12 h.p. and upwards. When ordering gas or oil engines they must be ordered to develop the requisite brake horse power at the *altitude* of the place at which they will be installed. The reason for this is that there is a considerable reduction in power at altitudes above sea level.

Refuse-burning producers will burn wood blocks or chips, cotton seed, mealie cobs and similar fuels. The consumption of charcoal in the charcoal-burning type for small sizes is about $1\frac{1}{4}$ lbs. per brake horse power per hour. In larger engines the consumption is slightly less.

It is advisable whenever possible to run the engine at full load, as the efficiency is then at its greatest and the fuel consumption at its minimum. In most engine-pumping installations a power head will be required. These consist usually of a simple reduction gearing, enabling the engine to run at fairly high speed while the pump plunger operates at about 30 strokes per minute. In selecting a suitable power head it will generally be found that the heavier patterns are the most suitable, but regard must be had to the depth from which pumping takes place. There is at the present time a combined engine and power head on the market, and for small lifts this will be found quite satisfactory. The fuel is paraffin oil.

Pumps.—The types of pumps obtainable are so wide in variation of design that it will not be possible to describe all, but a general description of those suited to small water supplies will be given. For this purpose pumps may be divided into three classes:—

- (a) Scoop.
- (b) Plunger or reciprocating.
- (c) Rotary.

Scoop Pumps.—These are adaptations of the earliest form of pump known. Usually a scoop pump consists of either a wheel with vanes attached round its circumference or else an endless chain of buckets. The most usual form of the latter

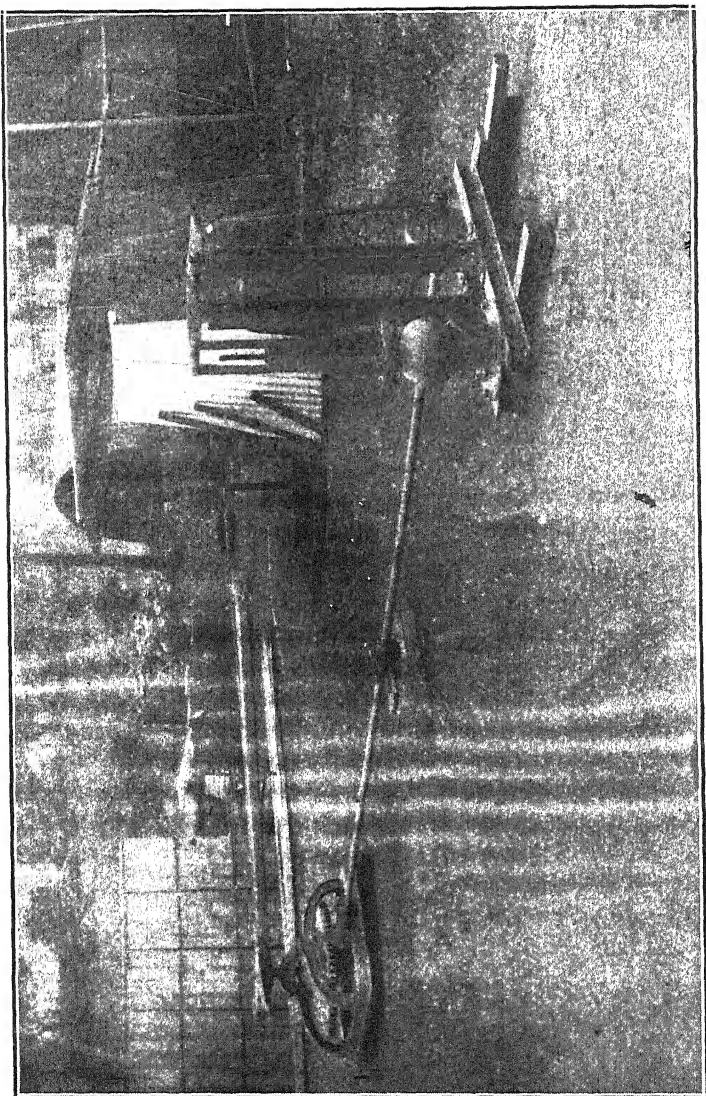
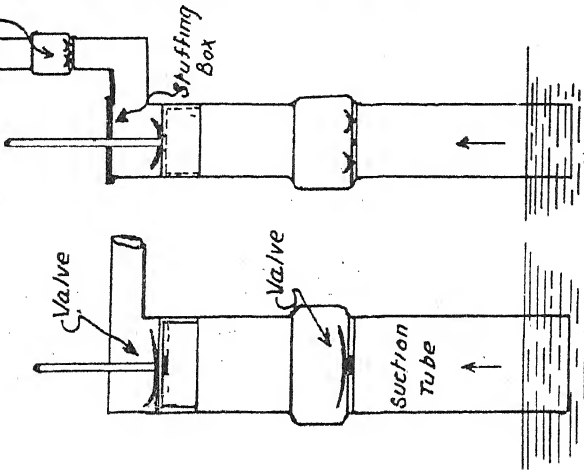


Fig. VII.
Animal pumping gear.

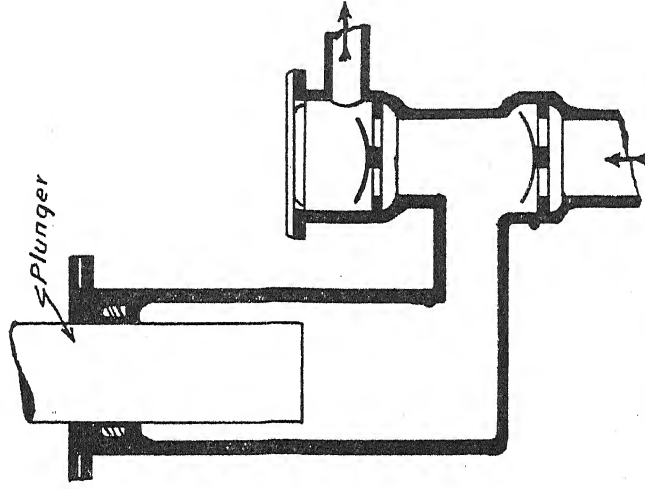
is the "Noria" or "Bakkies" pump, operated by animal power. Scoop pumps are suited to very low lifts only, certainly not above about 10 feet.

Plunger or Reciprocating Pumps.—The action of a pump may be divided into two stages—suction, and lift or force. If all the air were exhausted from a pipe and a perfect vacuum formed, at sea level water would rise in the pipe to a height of 34 feet. This is due to atmospheric pressure. As this pressure decreases with an increase in altitude, the height to which water will rise will be less. This height is known as the suction lift. In practice the suction lift is less than the theoretical, being for 5,000 feet altitude not greater than 18 feet. The first action of a pump is to exhaust air, and a whole or partial vacuum is formed in the suction tube below the pump, with the result that the water rises in the pipe. The pump then lifts or forces the water up to the desired height. Below the suction tube a foot-valve and strainer should be placed. The object of the foot-valve is to enable the suction tube to be kept full of water the whole time. In the lift type of pump the cylinder is provided with a valve at the bottom which opens upwards. On the up stroke of the pump this valve opens, and immediately at the commencement of the downward stroke the valve is closed by the weight of water above it. A second valve is contained in the pump, operating in a similar way, but closing on the up stroke. Figure VIII. shows a diagrammatic sketch of this bucket or lift type. By the addition of a closed top with a stuffing box, through which the pump rod passes, and a set of non-return valves on the delivery side of the pump, it becomes a force pump. The deep well or borehole cylinder pump is of this type. Another modification is the adoption of a plunger in place of the bucket, and a plunger pump results. This is also shown in Figure VIII. Reciprocating pumps are supplied as single acting—that is, working on one stroke only—or double acting, when work is done on both the upward and downward strokes. Where a large delivery is required, and where the diameter of a borehole is too small to allow of a large diameter cylinder being placed and it is not desirable to have too long a stroke, a double acting cylinder may be installed. This will deliver about 50 per cent. more water per stroke than a single acting cylinder, the power required being, of

Non Return Valves,

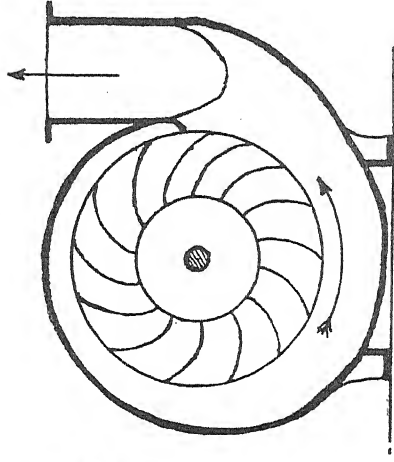


BUCKET
PUMP



PLUNGER PUMP

Fig. VIII.



CENTRIFUGAL PUMP

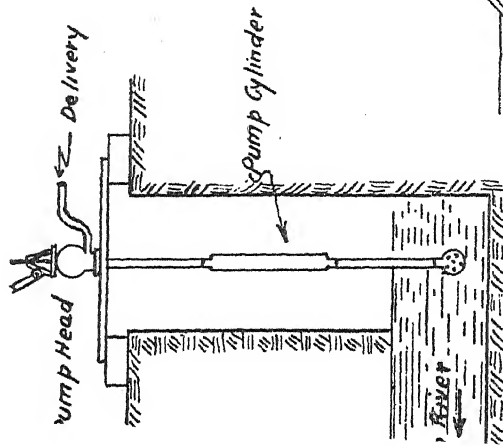
course, greater. The semi-rotary or wing pump is a link between reciprocating and centrifugal pumps. This type is a hand pump and is suitable for lifts up to about 80 feet. It is manufactured to deliver large volumes of water. It will not draw below 18 feet lower than the pump itself.

TABLE OF CAPACITIES OF WELL OR BOREHOLE
PUMP CYLINDERS.

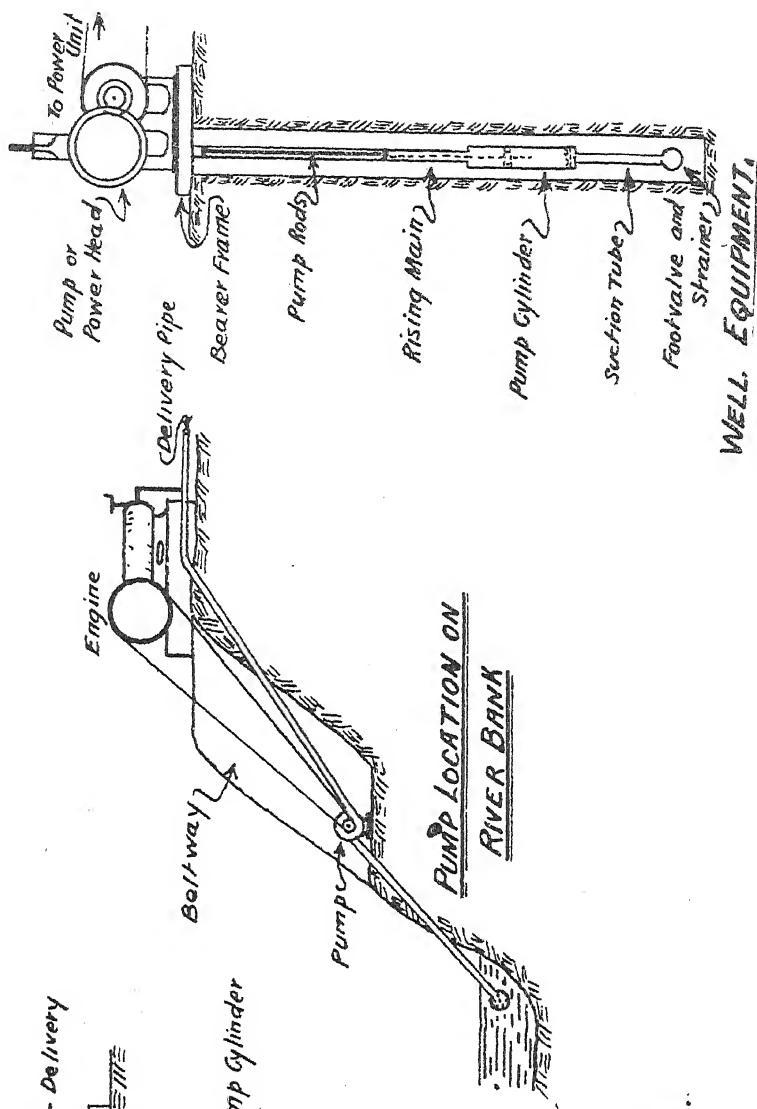
Inside diameter of cylinder. (Inches).	Length of stroke. (Inches).	Capacity per stroke. (Gallons).
2	12	.136
2	16	.181
2½	12	.212
2½	16	.283
3	12	.306
3	16	.408
3½	12	.413
3½	16	.551
4	12	.544
4	16	.725

Centrifugal Pumps.—This pump is in its essentials a reversed water turbine. It is suited to large volumes of water being delivered continuously, but has the disadvantage that it cannot be fixed at any great height above the water to be lifted. This height is limited to about 10 feet. The force lift for best working is as a rule small, being limited to about 50 feet, but deliveries to greater heights can be obtained by pumps of special construction. A diagrammatic sketch of this type of pump is shown in Figure VIII.

Location of Pumps.—As regards the location of pumps in wells and boreholes, the only precautions to be taken are to see that the pump is placed sufficiently far down to allow of water being raised when the water table is at its lowest, and to keep the foot-valve as far above the bottom of the well as possible. This latter precaution is to avoid sand and sediment being pumped up.



TRENCHED BACK
FROM RIVER.



WELL. EQUIPMENT.

Fig. IX.

In pumping from a river a deep pool with rock bottom is the best suited for pump location. Trenching back from the river is to be recommended as a means of keeping the engine, etc., away from the reach of floods. Another method is to set the engine as high up as possible and utilise a long belt driving down to the pump, which may be left below top flood level. These two locations are shown in Figure IX.

Borehole or Well Equipment.—The general pumping equipment for a well or borehole consists of a foot-valve and strainer, suction tube, pump cylinder, rising main and pump rods, bearer frame, pump head and power unit (Figure IX.).

(To be continued.)

Southern Rhodesia Weather Bureau.

AUGUST, 1935.

Barometric Pressure was a little above normal for the month in the south, but normal in the north.

Temperature.—The month will long be remembered by the severe cold experienced during the first half of the month. Not only were the temperatures recorded exceptionally low, but the length of the cold spell was also unprecedented. The mean temperatures for the month at most stations were 4 or 5 degrees F. below normal.

Rainfall.—Light rains were recorded at the majority of the reporting stations.

Snow.—Authentic reports of snow were received from Selukwe on the 5th; a motorist ran into a fall of snow on the road near Wedza, in the S. Marandellas district, on the morning of the 6th. On the following morning snow was reported to be lying on the hills near Inyanga. The only previous authentic record of snow in any quantity was in September, 1930, at the southern end of the Eastern border. The occasion was a cold snap which almost equalled the one of the present year in severity, but was of very short duration.

AUGUST, 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point F.	Cloud Amt.	Precipitation.			Altitude (Feet)
	Mean.	Normal.	Absolute.		Mean.							Ins.				Nor- mal	No. of Days		
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.									
Angus Ranch...	...	...	88	40	73.7	47.8	60.8	64.4	57.9	51.2	63	45	...	0.02	0.02	1	...
Beit Bridge...	972.1	...	88	38	75.9	48.3	62.1	...	59.0	51.6	61	45	2.2	...	0.09	...	1,500		
Bindura...	896.5	...	85	39	72.4	45.9	59.2	...	56.7	50.6	66	45	2.0	...	0.03	...	3,700		
Bulawayo...	873.2	872.8	82	32	68.8	42.8	55.8	60.8	55.2	45.8	50	35	2.9	...	0.03	...	4,426		
Chipinga...	897.9	...	79	39	65.6	46.5	56.1	...	56.0	50.3	71	45	4.5	...	0.54	9	3,685		
Enkeldoorn...	861.9	...	79	32	67.0	41.4	54.2	59.9	53.2	46.4	63	39	3.3	...	0.17	0.04	4,788		
Fort Victoria...	901.4	900.7	84	32	68.4	42.2	55.3	59.0	54.5	47.6	62	41	3.5	...	0.46	7	3,571		
Gwaai Siding...	909.2	...	88	27	77.7	38.0	57.9	...	55.3	46.4	50	37	1.0	...	...	...	3,278
Gwanda...	912.2	...	83	33	70.0	45.7	57.8	...	54.6	46.8	57	39	3.4	...	0.19	2	3,229		
Gwelo...	866.8	...	82	36	68.6	41.5	55.1	59.6	53.4	45.5	56	37	3.0	...	0.08	...	4,628		
Hartley...	900.6	...	83	34	72.9	40.9	56.9	61.0	56.0	47.3	53	38	1.0	...	0.01	...	3,879		
Inyanga...	840.2	...	75	35	65.0	41.5	53.3	...	53.7	45.3	54	36	2.0	...	0.43	3	5,503		
Marandellas...	841.3	...	76	32	64.7	41.8	53.3	...	50.8	44.5	64	38	3.2	...	0.35	2	5,452		
Miami...	883.2	...	83	37	72.3	44.1	58.2	...	57.9	48.8	52	40	1.1	...	0.04	...	4,078		
Mount Darwin...	912.6	...	87	35	74.5	44.2	59.4	...	59.5	51.0	56	44	0.8	...	0.05	1	3,180		
Mount Ntzu...	804.2	...	70	29	53.0	39.0	46.0	...	44.5	39.9	72	34	4.8	...	0.80	7	6,668		
Mtoko...	882.2	...	83	37	71.0	46.4	58.7	...	58.4	49.9	55	42	1.0	...	0.08	2	4,140		
New Year's Gift...	...	...	87	41	73.0	47.1	60.0	...	57.6	51.4	62	46	...	...	0.11	5	2,690
Nuanetsi...	969.4	...	87	34	75.3	44.5	59.9	...	59.3	52.1	63	46	3.2	...	0.06	...	1,580		
Plumtree...	868.7	...	81	34	68.4	45.8	57.1	...	55.4	45.0	45	33	1.0	...	0.06	...	4,549		
Que Que...	886.7	...	84	34	72.1	42.6	57.4	...	55.3	46.5	52	37	2.5	...	0.01	...	3,999		
Rusape...	866.4	...	79	31	66.7	40.2	53.5	...	50.8	46.5	74	42	2.2	...	0.30	4	4,647		
Salisbury...	858.6	838.6	80	34	69.4	41.8	55.6	59.6	55.5	46.5	52	37	2.1	...	0.12	1	4,885		
Shabani...	913.7	...	85	41	70.7	48.6	59.7	...	55.4	47.7	58	40	3.8	...	0.23	2	3,193		
Sinofa...	893.0	...	85	34	74.5	39.3	56.9	...	56.7	48.3	54	40	0.6	...	0.09	1	3,794		
Spillo...	889.5	...	81	38	71.9	46.0	59.0	...	59.2	48.9	47	38	1.1	...	...	...	3,876
Stapleford...	845.9	...	75	26	59.4	35.1	47.3	...	49.5	45.6	53	42	4.4	...	0.64	7	5,290		
Umtali...	898.5	897.6	84	35	69.4	45.3	57.4	61.4	55.6	50.0	69	45	3.7	...	0.19	6	3,672		
Victoria Falls...	916.7	...	89	34	79.3	44.9	62.1	...	56.6	47.6	51	38	...	...	...	...	2,990
Wankie...	932.5	...	90	44	79.6	52.1	65.9	...	60.0	49.3	46	39	0.5	...	0.01	...	2,567		

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 33. August, 1935.

Swarms of winged locusts of the red species (*Nomadacris septemfasciata*, Serv.) have been in evidence in various parts of the Colony during August. The swarms have been described as from "small" to "enormous" and "terrific."

The districts visited by locusts include Victoria, Matobo, Gutu, Bikita, Mtoko, Darwin, Inyanga, Lomagundi, Hartley, Mrewa, Salisbury, Umtali, Melsetter and Sebungwe, indicating a more or less general distribution, excluding the extreme western and southern part of the Colony.

The swarms have continued to haunt the more humid section of the eastern border, especially in the Chipinga sub-district (Melsetter district) and much damage to young grass, trees, etc., is reported.

Specimens examined have shown no indication of disease or parasites.

The prospect in respect to the next hopper outbreak apparently depends upon the intensity of the anticipated pre-breeding invasion from the north about November and meteorological conditions during the approaching wet season. There are clearly sufficient locusts in the Colony at present to produce a considerable outbreak of hoppers somewhere, if conditions prove favourable to breeding.

ROBERT W. JACK,

Chief Entomologist.

Southern Rhodesia Veterinary Report.

JULY, 1935.

AFRICAN COAST FEVER.

No cases occurred at any of the infected centres. The slaughter of the herd on Sigaro Farm, Salisbury district, was started.

FOOT AND MOUTH DISEASE.

No further outbreaks or extensions occurred.

ANTHRAX.

One beast died in the Mazoe district and the herd was inoculated.

TRYPANOSOMIASIS.

Seven cases in Melsetter district.

TUBERCULIN TEST.

Twenty-four animals were tested upon importation with negative results.

MALLEIN TEST.

Thirty-nine horses were tested upon entry; no reaction.

IMPORTATIONS.

From the United Kingdom.—1 Bull.

From the Union of South Africa.—Bulls 3, cows 20, horses 37, sheep 84.

From Bechuanaland Protectorate.—Sheep 801, goats 73, pigs 41.

EXPORTATIONS.

To Northern Rhodesia :—Sheep 215, goats 20.

To the Union of South Africa.—Horses 2.

EXPORTATIONS.—MISCELLANEOUS.

To the United Kingdom in Cold Storage.—Chilled beef quarters, 13,497; frozen boned beef quarters, 9,289; tongues, 11,485 lbs.; livers, 28,235 lbs.; hearts, 15,796 lbs.; tails, 6,224 lbs.; skirts, 5,468 lbs.; shanks, 26,725 lbs.; kidneys, 3,252 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 42,647 lbs.; meat meal, 86,000 lbs.; beef powder, 46,636 lbs.; corned beef, 22,032 lbs.

From Rhodesian Export & Cold Storage Co.—Horns, 13,413 lbs.; sinews, 1,539 lbs.; beef fat, 39,633 lbs.; casings, 6,313 lbs.; bacon, 1,617 lbs.; frozen baconers, 8,802 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Farming Calendar.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolie cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time

of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of $1\frac{1}{2}$ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation.

Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and camp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheepshed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (*heteronychus*), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphid may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

FOR SALE.

Order your TOBACCO CURING RECORD BOOKS from The Art Printing Works NOW, 5/6 each, post free. Sample Sheet on request.—Phone 2428 or write Box 431, Salisbury.

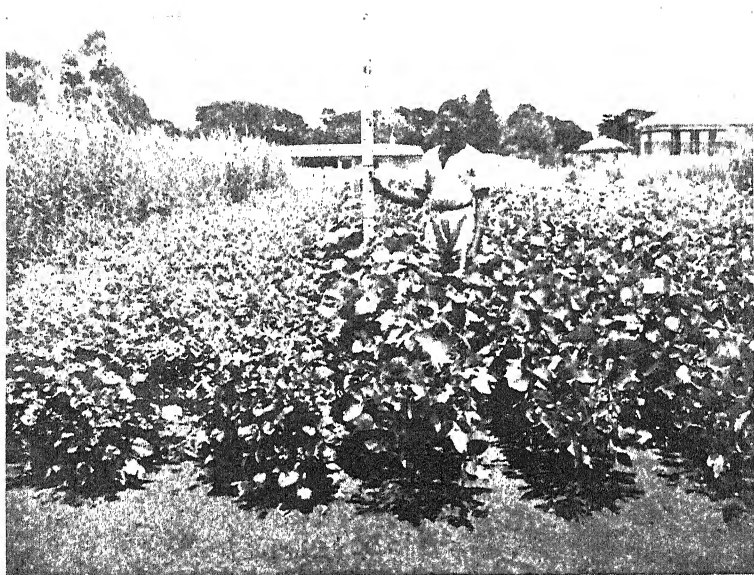
FOR SALE.—Sommerset Sunn Hemp, 17/6 bag; 10 bags at 17/-; broadcasts 10 acres a bag; f.o.r. Tafuna; c.w.o.—C. M. Townshend, Shamva.

FOR all classes of WHITE LEGHORN and AUSTRALORP stock write to E. E. C. Green, The Kloof Stud Poultry Farm (The home of the long-distance layer), P.O. Box 879, Bulawayo.

SOUTH DEVON BULLS.—“Norwood Trooper,” registered, 7 years, £25 Bulawayo. Five Bulls, 2 to 4 years, above sire, well grown, veld reared, £10 each Bulawayo.—Howard, Box 547, Bulawayo.

WANTED.

COLLECTIONS of Insects, unmounted; also Microscopic Material for Museum; cash or exchange.—C. Dods, Poste Restante, Salisbury.



Cowpeas (left) and Soya Beans (right). An upright variety of cowpeas known as Poona and Otxi Soya Beans. Both are very valuable fodder crops and drought resistant.



"Biltan" Soya Beans. This selection has yielded very heavy crops of hay during the past four seasons. It thrives in both wet and dry seasons.

THE RHODESIA Agricultural Journal

*Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).*

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

NOVEMBER, 1935.

[No. 11.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Soya Beans.—We have received numerous enquiries from farmers regarding the cultivation of soya beans. For a number of years experiments have been continued on the Salisbury Experiment Station and practically all the better known strains have been tested. It is definitely proved that the growth of the crop may be much increased by inoculating the seed with the specific bacteria required by the crop, excepting perhaps when the crop is grown on fertile soils, well supplied with organic matter. In order to increase the bacterial population of the soil it is advisable to grow soya beans on the same land for two or three years in succession, after which a rotation of crops in which soya beans occur every third or fourth year should be practised. In this manner the advantage of crop rotation could be secured without

seriously reducing the virility of the soya bean bacteria which will have become firmly established in the soil. Under these conditions several of the varieties tested, *e.g.*, Otootan, Otoxi and Biltan are remarkably successful as fodder crops. The two better kinds are selections from Otootan stock which have proved somewhat more productive than their parent. Owing to the dark colour of the seed of these varieties it is not suitable for commercial purposes. For the export trade the yellow-seeded Herman variety is the only one which could be grown, but at the present time the depressed condition of the overseas market renders the export of this seed unprofitable. Owing to dry conditions or to other unknown factors the pods of all the more valuable varieties split and the seed is dispersed before the crop can be reaped. Several crosses with non-shattering but otherwise inferior strains have been made in the hope of evolving varieties suitable for Southern Rhodesia conditions which will combine good growth and seed retention. The loss of seed which normally occurs through shattering can be minimised by reaping the plants before they are fully ripe, *e.g.*, when about half the leaves have fallen or as soon as the first pods have split open. After wilting for a few hours in windrows they may be tied up in bundles of convenient size, and a number of these placed in a circle to form a "shock" or "stook," where they may remain until they are completely dry. Another method is to build a small stack around a tripod of sticks after the manner employed in countries where inclement weather prevails during the harvesting season. This ensures the free circulation of air through the stack, cures the material without the formation of mildew, protects the largest possible proportion of the pods from drying effects of wind and sun and so reduces the loss of seed to the minimum. This method was employed with the Biltan variety at the Agricultural Experiment Station last season and it was found that only 8 per cent. of the seed shattered, although the stacks remained in the field for a period of eight weeks pending threshing operations.

Agricultural Legislation.—In accordance with a resolution passed by the Rhodesia Agricultural Union at its Congress last month, it has been decided to publish explanatory notes on the various Acts which have been promulgated in the

interest of Agriculture in this Colony. In this number the Tobacco Pest Suppression Act of 1933 is dealt with.

The suggestion is welcomed, and it is hoped that others will be put forward by anyone who has ideas on how this *Journal* can be made more useful and more attractive to the farming community.

Pawpaw Leaves Rich in Protein.—The following results of analysis of pawpaw leaves is supplied by the Chemistry Branch and indicate that, judged on the air dried material, these leaves have a high protein value. The leaves were picked in June, the stalks were removed and the leaves, including the midribs, were ground and mixed.

Results of analysis:—

Moisture	9.7
Ash	11.1
Crude Protein (N x 6.25)	22.5
Ether Extract	3.9
Fibre	9.7
Carbohydrates (by difference)	43.1
	<hr/>
	100.0
	<hr/>
Nutritive ratio	1:2.7

New Crops Tested Out.—*Mentha piperita* (Mint).—Five bags of roots were introduced in 1922 and issues were made to several farmers with irrigation facilities. On the Salisbury Station the crop grew fairly well during the rainy season, but failed completely during the dry season. Under irrigation satisfactory growth was made in the first season, but in the second season the plants were attacked by a leaf spot which severely affected the growth of the plants. On heavy soils under irrigation the plants may have commercial properties.

Pelargonium (Geranium Oil).—Cuttings of the varieties *P. graveolens*, *P. capitatum* and *P. radula* were obtained from Kirstenbosch, and *P. radula* from Kenya, two years ago, with the object of investigating the possibilities of producing geranium oil commercially. Difficulty was experienced in

striking *P. radula*, and rooted plants of that variety were eventually obtained from Kirstenbosch, in May last. Small plots of *P. graveolens* and *P. capitatum* have now been established. Leafy material from these two varieties was recently handed to the Chemistry Division for distillation. The determination of their oil content is not yet complete, but tests indicate so far that the material is still immature, and that the oil produced has a distinct lemon-like odour.

Chenopodium (Oil of Chenopodium).—A small sowing was made at the beginning of this season. A large proportion of the plantlets died in the seedling stage following the excessive rains. The few plants which survived have grown well, having reached a height of two to three feet. It is proposed to make more extensive trials with this crop next season from seed produced on the Station.

Colonel Nangle, Hunters Road, imported large quantities of seed from America last year. Germination tests with this seed made by the Department indicated that the seed on arrival in Rhodesia was not viable. It is thought that possibly the fumigation of the seed in America was responsible for its non-germination.

Datura stramonium.—Sowings were made several years ago, but the poor germination obtained prevented any useful information being obtained. Its cultivation would seem to present no great difficulties, and the crop is one which might be produced commercially by natives in Southern Rhodesia as a cash crop.

Pyrethrum.—Investigations with this crop are still proceeding, it has not proved a success when grown under dry land conditions at the Station. Several plant selections have been made from the original mixed strains propagated, and it is possible that more suitable strains will result which might warrant its cultivation under irrigation and possibly on dry land.

Dried Fruit Refuse.—The use of dried fruit by-products for livestock feeding has recently been investigated at the Florida Agricultural Experiment Station at Gainesville, where it has been shown that dried grape fruit refuse can be successfully fed to cattle. The product, which is prepared by a special

drying process, is derived from the peel, rag and seed of the fruit. In its final stage it consists of flakes and shreds somewhat coarser than beet pulp. In colour dried grape fruit refuse varies from a golden brown to a bright gold. It is characterised from other common stock feeds by a high content of citric acid, pectin and soluble sugars and by the presence of glucosides, pigments and essential oils. Its composition is: 91.77 per cent. dry matter, 4.94 per cent. crude protein, 11.94 per cent. crude fibre, 60.60 per cent. nitrogen-free extract, 1.06 per cent. crude fat and 4.23 per cent. ash. In view of its low fibre content and high percentage of nitrogen-free extract, dried grape fruit is regarded as a high carbohydrate concentrate.

The palatability of dried grape fruit refuse was tested in the dairy herd of the Florida Agricultural Experiment Station by offering one pound of the product to the individual cows of the dairy herd after they had eaten the normal quantities of maize silage and mixed grain. Of the 31 cows only one refused to eat the refuse, while their appetites for it increased progressively during a six-day trial.

In the digestion trials which were conducted with four steers the grape fruit refuse was fed with cotton seed meal and lucerne hay. These trials were continued for 30 days, 10 of which were preliminary and 20 experimental. Analyses revealed that approximately 25 per cent. of the protein, 71 per cent. of the fibre, 92 per cent. of the nitrogen-free extract and 80 per cent. of the ether extract had been digested by the steers. It was shown also that the products contained 1.23 per cent. digestible crude protein and a total of 76 per cent. digestible nutrients.

The general feeding qualities and effect of dried grape fruit were tested on eight heifers in a feeding trial that lasted 120 days. The daily ration used consisted of 30 lbs. of sugar cane silage, replaced at the end of 80 days by sorghum silage, 15 lb. of dried grape fruit refuse and 5 lbs. of cotton seed per 1,000 lbs. liveweight. This ration is very palatable. Although grape fruit refuse has a laxative action its general effects on animals were favourable, as indicated by thrifty appearance, the gloss of the coat and the improvements in thickness of flesh.

The experiments which have been conducted so far tend to show that when the drying processes have been perfected grape fruit refuse may become a profitable by-product instead of a source of waste in a cannery. Further studies on its physiological effects on the animal are still needed, however, as little at present is known on the subject.—Bulletin No. 275, University of Florida.

Publicity.—The latest publicity publication, "Southern Rhodesia, The Happy Land of Africa," which has just appeared, reflects the greatest credit upon all who have been associated with its production. The reading matter is excellently presented, the illustrations are unique; the advertisements compel attention; and the paper, type and general production leave nothing to be desired. It was published by Rhodesian Publications, Ltd., and printed by the Art Printing Works, Ltd., Salisbury. It would be difficult to imagine a more suitable or more attractive piece of publicity propaganda. It is now on sale by booksellers at half-a-crown per copy and should supply the answer to the question which will soon arise as to what to send to friends and relatives overseas for Christmas. There will be no longer any need to spend time in trying to describe the land we live in.

Chemistry in the United States.—Perhaps the most remarkable thing about the meeting of the American Chemical Society, held in April last in New York, and widely heralded as the "Official Tercentenary" of American chemical industry, was the presence of more than 25 per cent. of the very large membership, some 17,000, of that Society.

The social side was well to the fore, a feature being the replacement of elaborate and costly functions by a series of breakfasts, luncheons and dinners, arranged for the former students of the numerous universities. A director of the Du Pont Company claimed that they are on the way to establish an American synthetic rubber industry, and that this has been made possible by the experience gained in the dye industry, which in particular must be in the position to expand quickly in a national emergency to make a variety of essential organic substances.

Emphasis was also laid on the popular use and significance of vitamins, preparations containing such now having the third largest sale in the drug stores.

As a novelty, it was proclaimed that young cereal grasses cut just prior to jointing have, when dry, a biological value many times that of the common vegetables and that men and women will be eating grass in the near future.

The Rothamsted Report for 1934.—The Rothamsted Experimental Station is the leading institute for the study of soil science, plant nutrition, and plant disease. Its activities cover a wide field. There are the well-known experiments on the parent farms at Rothamsted and Woburn, amplified by similar trials at a number of outside centres. In addition the laboratory workers are applying the methods of chemistry, physics and biology to the many problems arising in crop production and utilisation. The appearance of the annual report for 1934 enables all interested in the land to obtain a clear view of the recent activities of the Station. Progressive farmers and their technical advisors will turn to the sections summarising the results of recent fertiliser investigations and continue with the detailed account of the field experiments of 1934. The scientific specialists, to whom the report needs no recommendation, will find a welcome feature in a series of review articles on the contribution of certain of the Departments to their respective branches of soil science. Dr. Keen writes on soil physics, Dr. Crowther on chemistry of soils and fertilisers, Dr. Thornton on soil bacteriology, and Mr. Cutler on general biology. Accurate information on the effects of organic manures, and in particular of dried poultry manure, is now beginning to accumulate. Neither in 1933 nor in 1934 was the activity of the nitrogen of dried poultry manure as great as that of sulphate of ammonia. Recent work on basic slags tends to show that their solubilities as measured by the old citric acid test is a good guide to their agricultural availability. Work on the maintenance of organic matter by ploughing in straw, or manures made from straw, or green manures, still continues. This side of the work, in conjunction with the continuous cereal plots testing the effects of bare fallowing, is of special bearing on soil fertility under mechanised cereal farming.

The report contains a useful summary of the Rothamsted work on virus diseases. It has been found that the inoculation of a plant with one strain of virus may protect it against a later inoculation with another more virulent strain of the same virus. The part played by insects in the transmission of these diseases is discussed in the light of recent experiments.

Wanted.—In order to complete the set of this *Journal* the Government Archivist, Box 363, Salisbury, would be glad to hear if any reader can supply No. 5 of Volume 9, 1911.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Cactus Slabs (blades) Algerian and Moscatel varieties, per 100 Slabs 5/- delivered at the Salisbury Experiment Station, or 7/6 delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made on orders received before October 31st, 1935.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns and Cactus Slabs during November and December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury. (Oct.-Nov.)

Department of Agriculture and Lands.

IMPROVED U.4/64 COTTON SEED.

Seed of the newer, U.4/64 strains, mainly improvements on U.4/64/7/10 (Gatooma 5-11), are available for sale to growers, in 50 lb. lots, at a charge of 5/- per lot.

The seed has been grown during the past season on the Government Cotton Breeding Station, Gatooma, and is approximately 70% sound.

Applications for cotton seed must be accompanied by a Postal Order or cheque for 5/- made payable to the Accountant, Division of Agriculture and Lands, Salisbury. Exchange must be added if cheques are not drawn on Salisbury.

Applications for seed should be addressed to the Plant Breeder in Charge, Cotton Breeding Station, Gatooma, as early as possible. They will be dealt with in the order in which they are received.

For bulk quantities of U.4/64 strains, grown from earlier Gatooma issues, application should be made to the Bindura Ginnery, Bindura.

H. G. MUNDY,

Secretary,

Department of Agriculture and Lands.

23rd August, 1935.

(Sept.-Nov.)

Tobacco Pest Suppression Act, 1933.

This Act, which replaced one of the same name of two years earlier, was promulgated by Government Notice 312 of May 19th, 1933.

The object of the Act is to protect the growing crop from pests which may be carried over on plants remaining from the previous season—or growing out of season—and also to protect the stored, cured crop from pests found in dirty or neglected stores. Provision is made for an inspector appointed by the Minister of Agriculture and Lands to visit any land where tobacco is growing—or has been grown, or any premises where tobacco is handled or stored and to order any action to be taken which he considers necessary to comply with the provisions of the Act. The powers conferred under the Act are wide, and either growing plants or cured tobacco may be destroyed if considered a danger to the industry. Cured tobacco includes any tobacco leaf or stalk in a dry condition.

Certain pests of growing tobacco are specifically referred to in the regulations under the Act, *viz.*, the tobacco white-fly and tobacco-leaf curl.

In order to minimise the danger to new crops it is laid down that “By the first day of August in any year the owner of any land shall have caused to be uprooted and destroyed all growing tobacco plants, including living stalks and roots, and all plants declared to be alternate hosts, which have been growing on his land; provided that in the case of tobacco plants of the Turkish type the date by which such plants shall be uprooted and destroyed shall be the first day of September in any year.” Alternate hosts are any plants upon which the white-fly will live and feed, or which are infected with the leaf curl disease.

“The method of destruction to be practised shall be included in the following:—

- (a) Burning.
- (b) Conversion into manure by process approved by an Inspector.
- (c) Any other method approved by an Inspector."

In the event of an owner failing to destroy tobacco plants or stalks or alternate hosts on his land by the date fixed by regulation, and in the case of absentee owners, the Minister may take the necessary measures to destroy tobacco plants and stalks and alternate hosts on such land and may recover any costs incurred by such destruction from the owner of such land.

If the Minister is of opinion that any growing tobacco plants finally set out for the crop of the current season are so infested with a pest of growing tobacco that cleansing thereof is not likely to prove successful in eradicating the pest, he may order the destruction of such plants before harvest.

The Minister shall give notice to the owner of such plants of his decision to effect such destruction, and such owner may appeal within seven days of the receipt of notice of destruction.

The pests of cured tobacco definitely referred to in the Act are the stored tobacco worm (*Ephestia elutella*) and the stored tobacco beetle (*Lasioderma serricorne*). In order to ensure that tobacco moved from the farms shall be free from pests the Act provides that "It shall not be lawful for any person to remove or cause or permit to be removed, tobacco from any premises which are not licensed in terms of the Act."

All persons, when consigning unmanufactured cured tobacco by rail or other public carrier, shall enter upon the Consignment Note and address labels the number and date of the licence held in respect to the premises in which the tobacco was last handled or stored.

The railways or other public carrier shall not accept such tobacco for transport unless the consignment note and address labels are so endorsed.

Upon application by the owner of premises in the manner prescribed by regulation the Minister shall issue a licence in the prescribed form and such premises shall during the currency of such licence be regarded as licensed premises; provided that the Minister may order an inspection of such premises by an Inspector and may refuse the issue of a licence until he is satisfied that such premises are free from any pest of tobacco.

Such licence shall authorise the removal of tobacco from the licensed premises and shall remain in force during the period stated therein.

The owner of licensed premises who knows or has reason to believe that such premises or their contents are infested with a pest of tobacco shall immediately notify the Minister of the fact and shall cease to remove tobacco therefrom.

Such owner shall thereupon cleanse the premises and their contents in a manner ordered by an Inspector.

No person shall remove tobacco from such premises until an Inspector has issued a certificate to the owner thereof that such premises have been duly cleansed.

In the event of tobacco being removed:—

(a) from unlicensed premises

or

(b) from premises infested with a pest of tobacco, an Inspector may seize such tobacco and the Minister may order the confiscation or destruction of such tobacco.

The confiscation or destruction of such tobacco shall not free the person responsible for such illegal removal from liability to prosecution.

If the Minister is of the opinion that any tobacco or agricultural product or any other material is so infested with a pest of tobacco that cleansing thereof by fumigation or otherwise is not likely to prove successful in eradicating the pest, he may order the destruction of such tobacco, product or material.

The Minister shall give notice to the owner of such tobacco, product or material of his decision to effect such destruction and such owner may appeal against such decision within seven days of the receipt of such notice of destruction.

Applications for licences must be received by the Secretary, Department of Agriculture and Lands, before the 31st day of December of the year preceding that to which the licence is to refer. If applications are received later than this date the person applying must undertake to pay any expenses which may be caused through the late application. The application must give the following particulars:—

- (a) The full name and postal address of the applicant.
- (b) The position of the premises to be licensed.
- (c) A statement as to whether tobacco, other than that grown by the owner of the premises, is to be handled or stored.

Within thirty days after handling has been completed ~~in each season all trash, unsaleable tobacco and refuse shall~~ be removed from all warehouses or other structures in which tobacco is handled or stored for sale or export. Only tobacco which is being kept for use or sale shall remain. The interior surface of the walls of all warehouses, storerooms, bulking, grading and packing sheds used for handling or storing tobacco shall then be sprayed or otherwise covered with hot limewash, at least one-third of the volume of which shall consist of quicklime. An Inspector may order the treatment to be repeated if deemed necessary.

An Inspector may order the removal from a warehouse, or other structure in which tobacco is handled or stored for sale or export, of any maize, maize meal, ground nuts, ground nut cake, or any other material which in the opinion of an Inspector may harbour insect pests or in which insect pests are found.

The Inspectors appointed under this Act comprise a number of technical officers of this Department, and in addition all European members of the British South Africa Police are *ex officio* Inspectors as far as the portions of the Act dealing with growing tobacco are concerned.

Notes on Witchweed Control.

By S. D. TIMSON, M.C., Dip. Agric. (Wye),
Assistant Agriculturist.

Ill-effects on Maize Crop Reported.—During the past three seasons the practice of trap-cropping for witchweed control with Amber Cane and White Kaffir Corn has spread greatly, but in a certain number of cases ill-effects have been noted on the succeeding crops of maize. It is with the object of explaining how this may happen, if care is not taken, and of clearing away any prejudice against this, the best and cheapest method of control of the parasite, which may form as a result of such ill-effects on the maize that this article is written.

Explanation.—In every case which the writer has investigated it has been found that the same mistake has been made, namely, that the Amber Cane or White Kaffir Corn has been ploughed under too late. The ploughing under of the trap crop should always be completed not later than two months or eight weeks after its germination. *At this stage of growth Amber Cane and Kaffir Corn have not yet commenced to flower.*

Now the research of various investigators at Rothamsted, in America, and elsewhere has shown that the bacteria which bring about the decomposition of organic matter in the soil obtain the nitrogen they require in the first place from the organic matter itself. If, however, this supply is inadequate, then they will rob the available nitrogen supply in the soil, building it up into their body protein in which form it is temporarily unavailable as plant food.

The work of Lyon, Bizzell and Wilson showed that this robbing of the available nitrogen from the soil takes place if the organic matter under process of rotting therein contains less than a minimum of 1.8 per cent. of nitrogen.

As pointed out in an article appearing in the *Rhodesia Agricultural Journal* in January, 1933, at eight weeks from germination Sudan Grass and White Kaffir Corn (stem and

leaf only) contain slightly more than this minimum of 1.8 per cent. of nitrogen. Actually they contained 1.89 and 1.82 per cent. of nitrogen respectively. However, as they mature beyond this stage the nitrogen content falls below the requisite minimum and in consequence the decomposition bacteria are forced to rob the soil of its available nitrate nitrogen and the following maize crop suffers from nitrogen starvation as evidenced by its yellow colour and poor growth.

This is the explanation, in the opinion of the writer, supported by several years experience of field results, and by the consistently excellent green manure effect of trap crops, obtained in each of four separate series of experiments carried on over six years at the Agricultural Experiment Station at Salisbury, of all those cases where definite ill-effects have been observed on the maize crop following the ploughing under of Amber Cane and Kaffir Corn.

When to Plough in Trap Crops.—It should be borne in mind, therefore, that trap crops of Sudan Grass, Amber Cane and White Kaffir Corn *must be ploughed under within two months from their germination* if good green manuring results are desired as well as the destruction of witchweed. The writer is well aware that the reason which has led farmers to postpone the ploughing in of their trap crops is a reasonable one, namely, that the witchweed had not come into flower at two months from germination of the crop and in some cases has not even appeared above ground, and they, therefore, decided to await the flowering of the parasite with the idea of allowing the trap-crop to germinate more of the seed. The dangers attending this practice will be apparent from the foregoing, and it is probable that by leaving the trap crop to grow beyond two months only a comparatively small increase in the amount of witchweed germinated will result.

It is, therefore, thought that any advantage gained in this way by postponing ploughing in of a trap crop will be more than off-set by the loss of yield of the following maize crop, which may result from the practice.

Ill-effects only Temporary.—It should be pointed out that any ill-effects resulting from late ploughing in of trap crops due to the reduction of the amount of available nitrogen in

the soil is merely a temporary one and will pass off as the season advances. In fact, eventually a considerable rise in the level of available soil nitrogen will be brought about by the stimulation of the activity of another type of bacteria which fix nitrogen from the air. The removal of the available nitrate nitrogen in the soil, and the addition of large quantities of carbonaceous organic matter, are conditions which favour the activity of these nitrogen fixing bacteria, together with the aeration of the soil brought about by the cultivation of the maize crop. However, this subsequent increase in the nitrogen content of the soil may be, under field conditions, too late to benefit the maize crop following an over mature trap crop.

What can be done to Help?—Where a trap crop has been allowed to mature beyond eight weeks from its germination the following suggestions are made to assist the farmer to remedy the condition of nitrogen shortage in the soil, which may result from it and cause a loss of yield of the following maize crop.

The planting of the succeeding maize crop should be delayed until the remainder of the maize on the farm has been planted. This delay should be utilised to cultivate and, therefore, aerate the soil by an additional shallow ploughing and by extra disc-harrowings and spring-tooth or drag harrowings. After planting the maize it should be drag-harrowed after it is above ground and also given two or more extra cultivations. The object of this extra cultivation is to aerate the soil, since this is the chief factor required for vigorous nitrogen fixation which should be aimed at so as to replace the available soil nitrogen temporarily immobilised by the decomposition of the too mature trap crop. The other chief requirement of the nitrogen fixing bacteria, namely, an abundant supply of carbonaceous matter, is already supplied by the organic material ploughed under. In addition to extra cultivation, the application of lime and phosphate, in the form of superphosphate, where these are deficient, will assist the fixation of nitrogen from the air. They should preferably be applied at the time of ploughing in the trap crop, or as soon after as the crop has rotted sufficiently to avoid its being turned up on the surface again by a shallow ploughing.

Where it is essential to obtain a high yield from the maize crop, sulphate of ammonia might be applied to replace the nitrogen robbed from the soil by the decomposition bacteria, but this can not be recommended as a general practice owing to the high cost of this fertiliser. However, where the trap crop was ploughed under late in the season and in full flower or at a more mature stage of growth and it is desired to obtain as high a yield of maize as possible, then the application of ammonium sulphate at planting would undoubtedly be beneficial.

Wet Seasons unfavourable for Trap Crop.—All the best trap crops are sorghums, which do not thrive under conditions of heavy rainfall, especially when these occur during the first half of the season, such as happened in the past season (1934-35), and they cannot, therefore, be expected to give their best results as trap crops in wet seasons, since inferior growth and development of their root systems will result.

In addition to this Saunders' research has established the fact that if the activating substance excreted by the roots of a host, which alone can cause the witchweed to germinate, is diluted beyond a certain point, it will not cause germination of the seed. During prolonged wet periods in the growing season there is little doubt that these conditions obtain and this, in part, explains the reduced amount of the parasite appearing above ground in maize crops in very wet seasons. Another factor is probably the low temperatures of the soil, which are caused by prolonged rainy periods and do not favour germination of the seed of the parasite for which the optimum temperature is about 86° F.

Farmers are warned, therefore, that they must expect somewhat inferior results from the trap crops grown during the past season and that they should not judge the efficacy of trap cropping on those results alone. In the same way the green-manuring effect of the trap crops will almost certainly be inferior owing to poor growth of the crops.

The above portion of this article was first published in the *Rhodesia Herald* and is reprinted here by the courtesy of the Editor.

Trap Cropping still the best method of Control.—Despite the above warning against the ill-effects, which may attend failure to carry out trap cropping properly as laid down in previous articles, which have appeared in this *Journal*, it must be emphasised that *trap cropping still remains, and will almost certainly remain, the best, cheapest and most rapid method of control of witchweed.*

Trap Crop Green-Manuring.—It is necessary also to emphasise that *trap cropping when correctly carried out is still to be looked on as giving practically as good results from the green-manuring point of view as sunn hemp, and rather better results than sunflowers*, when these crops are used as green-manures. None of the evidence from the many farms where trap cropping is now regularly being carried out has yet done anything but confirm the results of the experiments carried out at the Agricultural Experiment Station, Salisbury, over the past six years which were reviewed in the article by the writer published in this *Journal* last year (Witchweed, *Rhodesia Agricultural Journal*, November, 1934) and which are briefly summed up in the paragraph above.

The matter is of such grave importance to the maize farmers of this Colony that the writer makes no apology for once again urging on all those farmers whose fields are infected at all severely with this parasite, to substitute a trap crop green-manure such as Amber Cane or White Kaffir Corn, for the normal green-manure crop in their rotation, and thus bring this very serious pest rapidly and cheaply under easy control.

The practice is, the writer contends, proved to the hilt, and it only remains for the farmers of the Colony to put the method into practice on their own farms as early as possible, and adapt it to their own conditions. In this the officers of this Department are willing and desirous of assisting by advice or otherwise in so far as they are able.

Appeal to Farmers.—One thing the writer appeals to every farmer (particularly the influential ones) to do if they find results are not up to expectations, and that is before they

condemn the practice to their neighbours or acquaintances, that they shall give the writer an opportunity of examining the evidence and discovering where things have gone wrong.

Much harm has been done in the past by uninformed criticism of this method of control of the parasite, particularly by a few influential farmers, who have not carried out the method properly and so have had bad results from it.

The method is not fool proof, but neither is plain green-manuring. There is, however, nothing complicated or difficult about it, and there is no longer any excuse for any farmer whose lands are infested with witchweed to say he cannot control it. If he can green-manure his farm regularly he can also trap crop it.

If he is not able to green-manure his farm regularly, then he had better give up farming, for his capital, which is the fertility of the soil, will slowly but surely drain away.

Other Trap Crops under Trial.—During the past two seasons the writer obtained the co-operation of a number of farmers in testing out the value of two new crops as traps for witchweed, namely, Irungu Amber Cane and Native or Perennial Sudan Grass.

Irungu Amber Grass.—The former was introduced from India, through the courtesy of the Agricultural Research Institute, Coimbatore, and on the suggestion of the Economic Botanist, Kew (the writer wishes to acknowledge with thanks their kind assistance), and appears to be identical with the local Amber Cane, except that it grows considerably taller. On the farm of Mr. R. Thornton at Bindura it grew 3 to 4 feet higher than his maize, which was well grown. It appears to be a good host for witchweed and quite suitable for trapping it. For silage it would appear from the greater height attained that this strain of Amber Cane might be expected to give rather heavier yields of silage per acre than the local Amber Cane.

Native or Perennial Sudan Grass.—This was tested on four farms in the Mazoe Valley. It is a close relation to the Annual Sudan Grass, which has proved to be a valuable hay and green forage crop in this country for many years, but

it has the advantage over the latter in that it is a perennial. It is very similar to Sudan Grass in habit of growth and general appearance, but is a little coarser. It is indigenous to Southern Rhodesia, is very hardy and resistant to drought and diseases.

It is not possible to say to what extent it suffers from the disability of all sorghums in being poisonous to stock under certain conditions, but it probably ranks with Sudan Grass in this respect.

It is a free seeder, unlike Sudan Grass, and produces heavy crops of green growth for conversion into silage or hay, in which form it will be safe to feed to fattening and working oxen.

The great attractions of this grass are that it is a native to the country, and that it is a perennial, which has maintained itself year after year on the Agricultural Experiment Station, Salisbury, with little or no attention, and finally it is a heavy seeder.

With a little care in management, and with an occasional dressing of fertiliser, it should, in the opinion of the writer, prove a valuable permanent crop for silage and hay.

It is normally in full flower at the height of 6 to 8 feet, each year on the Agricultural Experiment Station, Salisbury, at Christmas.

A Good Host of Witchweed.—In addition to its other possibilities it shows great promise as trap crop for witchweed. On the farm of Mr. G. P. Ingram, at Amandas, last year, *it proved itself to be a very good host of witchweed.* It also made much better growth during the excessive rains of last season than Kaffir Corn or Amber Cane. As it is in addition a heavy seeder and a permanent crop, it is considered to be well worth the trial of farmers whose farms are infested with the parasite. *A small seed field may be kept permanently under the crop to supply seed.*

To other farmers it promises to be a valuable permanent silage and hay crop. I may mention that this crop has been under observation at the Agricultural Experiment Station for many years.

Small Supplies of Seed Available for Free Issue—Small samples of seed are available for free issue under the Department's Co-operative Experiment Scheme, to farmers desirous of testing this crop. Farmers who wish to test it as a host to witchweed will be given preference, and applications should be sent to the Division of Agriculture, Department of Agriculture, Salisbury. *Seed can be sown up to mid-January, but it is best to sow in December.*

It is suggested that, for seed propagation purposes during the first season, it should be sown in rows 28 inches apart with 3 inches between plants. Thereafter it may be broadcast at the rate of 20 to 25 lbs. per acre as a trap or silage crop. It should be sown with the first rains, but it may be sown up to early February to establish it.

Wintersome.—This crop, which is stated by its breeder, Mr. C. E. Freeman, of Natal, to have a Kaffir corn, a native grass, and a variety of sweet reed, I think, as its parentage, was tested in a pot culture for its ability to germinate witchweed. The test was very inconclusive, but it was clearly established that it is to some extent a host of witchweed, but it is not at present possible to say whether it is satisfactory in this respect or not.

One farmer grew the crop on witchweed infested soil, and reports it to be a good host.

It promises to be a very useful silage crop, but owing to its slow growth at the commencement, it is thought that it may not be really suitable as a trap crop.

It has been under trial as a silage crop at the Agricultural Experiment Station, Salisbury, for the past two seasons, and very heavy yields of green material have been obtained. It makes very palatable silage alone or with velvet beans.

Reports from farmers as to its usefulness as a trap crop compared with Amber cane or White Kaffir Corn will be welcomed.

It is reported by Mr. Freeman and one farmer in this territory to be free from the prussic acid poisoning objection, but the writer cannot vouch for this, and advises caution in feeding it in the green state until more experience of it when grown in this Colony is available.

Traps as Silage Crops.—The writer would like once more to remind farmers that all the trap crops recommended can also be made into excellent silage or hay, and thus can be utilised if so desired for feeding fattening or working oxen in winter.

Resistant Trap Crops.— In the article mentioned above a brief notice appeared mentioning the work being done by Saunders at Potchefstroom on this subject, and also mentioning the case of the local native crop Munga or N'youti.

This crop was tested by the writer in a pot culture for its resistance to witchweed with negative results, but in a test on a field scale on the farm of Mr. G. P. Ingram, at Amandas, it did not appear to be entirely resistant and, in fact, a number of the parasites grew vigorously and produced much seed. However, this evidence is inconclusive, since there is a possibility of the parasites having been germinated in the first place by weed grasses. At the time of the writer's inspection a number of the parasites appeared to be thriving on the Munga, but they may have been brought to the surface by weed grasses.

This testing of the local strains of Munga for resistance will be continued.

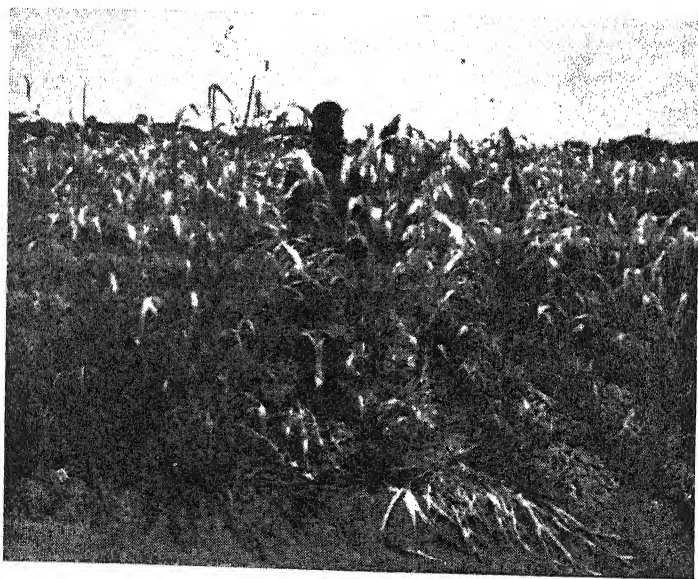
Broadcasting Traps on Stubble.—Further evidence of this method of sowing traps without previous preparation of the land has been collected, and in all cases confirmed the satisfactory results obtained in previous years. The writer advises, however, that the stubble shall be disc-harrowed before broadcasting the seed, and the seed be also covered by discing.

Safe Interval between Hand Cultivations.—The co-operation of 14 well-known farmers in the maize belt, who are known to be careful observers, was enlisted last season to assist in examining the important question of what interval can safely be left between one hand cultivation and the next.

Most of these gentlemen kindly carried out observations on the period between cutting the parasite by light surface cultivation and the appearance of the first flowers, either from virgin uncut plants or from new shoots put out by the stems of plants cut off by the cultivation.



White Kaffir Corn (left) and Native Sudan (right). Two months and one week old from germination. Note absence of flowers on Kaffir Corn.



Native Sudan (left) and Amber Cane (right). Two months and one week old. Note absence of flowers in Amber Cane.

Some of the reports are extremely full and form a valuable record, and from all the evidence put forward it appears safe to draw the following conclusions, the great importance of which will be obvious.

(1) The interval observed varies considerably according apparently to the climatic conditions, the type of soil, the fertility of the soil and the physical condition of the soil.

This was only to be expected, since all these factors affect the rate of growth of the parasite owing to their influence on the growth and vigour of the host, namely, the maize.

(2) At each successive cultivation of the parasite the interval elapsing before the reappearance of the first flowers steadily shortens.

(3) After the first cultivation the safe interval may vary between eleven and twenty-one days before the parasite flowers again.

(4) At the last cultivation the interval may be as short as eight days. In this case the host has, of course, ceased growth, and the parasites are compelled to obtain most of their food supply direct from the soil through their own root systems. The soil at this stage is rapidly drying out and so the food supply is therefore much reduced. These unfavourable conditions force the parasites to flower more rapidly, and the plants, flowers and seed capsules are all much stunted in growth.

(5) It is obvious from the above that no "safe" interval between cultivations can apply to all conditions and all periods of the growing season.

Advice on "Safe" Interval between Cultivations.—It is clear on the above evidence (if we can accept the evidence of only one year's observation, and in this case the writer is of opinion that we can) that the farmer must watch each of his fields carefully as the time draws near for the next cultivation and put his labour in to work as soon as the *first* flowers appear.

There is no "safe" interval, in other words, which is "safe" the whole season through, but a farmer can almost certainly reckon on at least 14 days' breathing space after

the first cultivation, but from then onwards the safe interval will narrow gradually until he may only have a bare week before he must cultivate again.

To sum up, the farmer must watch his infested fields day by day as the danger point approaches so that he will know when the first flowers appear.

In an emergency he can, of course, leave a field a further week before cultivation, *so long as he collects all parasites in flower*, but this is distinctly a dangerous practice; it is also much slower than cutting off the parasite and leaving it on the lands, and requires much more time and greater care spent in supervision by the farmer.

Re-growth of Traps after Ploughing.—The writer has seen one or two cases, and had others reported to him, where the trap crop has not been covered and killed properly by the ploughing down of the crop, particularly with Amber Cane.

Where this happens the trap crop may continue to make a certain amount of growth, and there is some danger of witchweed being brought to the surface and seeding down. A disc harrow or any implement tends to pull out the trap crop, and so cannot be employed for killing it.

The most convenient way of dealing with such a situation is to spray the clumps of trap crop not covered by ploughing with a 5 per cent. solution in water of sodium chlorate. Five pounds of the sodium chlorate are dissolved in 10 gallons of water, and a light but complete covering of the solution sprayed on to the foliage of the trap crop during dry weather.

Small spray pumps very suitable for this work, and also for whitewash spraying and other spraying on the farm, can be purchased locally at about 22s. 6d.

As an alternative to spraying labour must be put on to killing the re-growth with hand hoes.

Antidotes for Prussic Acid Poisoning.—The dangers of poisoning of stock by the sorghums used as trap crops (Amber Cane, Sudan Grass, White Kaffir Corn, etc.) have been mentioned in earlier articles by the writer in this *Journal*. Although only two occurrences of poisoning of stock have

been reported during the 5 or 6 years of trap cropping, there is always a possibility of a careless native allowing it to occur, and one or more of the following simple antidotes recommended by various authorities may be kept at hand, but *they must be used immediately to be successful*, since prussic acid is very rapid in action.

(1) Large doses of cane syrup, molasses and other forms of sugar, such as glucose and dextrose, may be administered.

(2) A large dose of Epsom salts, followed soon after by a large dose of raw linseed oil, may also be used.

(3) Potassium permanganate in solutions of up to half of one per cent. may be administered to render harmless by oxidation the prussic acid remaining unabsorbed in the gastrointestinal tract.

Feeds for Poultry and How to Use Them.

By G. H. COOPER, Assistant Poultry Officer.

(*Concluded.*)

SUCCULENT GREEN FEEDS, ROOTS, ETC.

Succulent green feed plays a most important part in poultry feeding. Its value lies not in its feed value as expressed in proteins or carbohydrates but in its vitamin content and its other health promoting properties on the digestive system, such as distension of the intestines and variety, thus enabling the bird to make greater use of other feeds. Not least of its value lies in its promotion of good health, thus effecting a great saving from disease and loss of products. It has a cooling effect on the system which is very beneficial in a hot climate, and it assists very materially in the more economic production of both eggs and table birds. Most types of succulent green feed should be finely chopped and fed fresh to the birds in troughs or wire baskets.

Cabbage.—The leaves of cabbages or small unmarketable heads make an ideal succulent green feed for poultry and one that is greatly relished. The green leaves contain more Vitamin A than the white portion.

Cactus, Spineless.—In times of drought or in districts where it is difficult to grow other greens, spineless cactus may come in very useful indeed. As a standby some should be grown on every farm. The leaves are cut into strips with a knife and the birds, when accustomed to it, will eat all the succulent feed from the centre. It most likely carries Vitamin A.

Carrots.—The best variety to grow is the yellow carrot, which has been shown to carry Vitamin A, whereas other varieties do not. These carrots are the best root crop available to substitute for fresh greens. They are very beneficial for turkeys. Yellow carrots should be chopped into small chunks for feeding.

Grass.—Green grass is the natural feed for poultry, and when young and succulent is very beneficial. Free range on green grass is ideal. Green grasses contain all the vitamins of importance.

Lettuce.—For chickens this succulent green feed is excellent, as it is soft and easily digested. All classes of stock greatly relish it. It contains the essential Vitamin A and may safely be used wherever available.

Lucerne.—Like green grass lucerne contains all the known vitamins and is one of the most widely used green feeds. It also contains some protein and lime which is essential for all poultry. It is greatly relished and can hardly be bettered as a succulent feed for all classes of stock.

Mangels.—Where available mangels may form a useful substitute for greens. They are low in Vitamin "A," however, so this should be supplied by yellow maize or other feed. Mangels may be stored and when fed should simply be cut in half lengthways and the birds allowed to pick out the succulent feed.

Melon, Cattle (Majorda).—This feed is grown on practically every farm, and in conjunction with spineless cactus may well replace the use of root crops as succulent feeds in this country. Melons being green probably contain Vitamin "A" in sufficient quantity. Where no succulent green feed is available they may be cut into quarters and placed for the birds to help themselves. Keep out of the hot sun. Melons, when cut, soon become sour if not consumed and may cause digestive trouble, so they should be fed fresh daily and all not consumed taken away at night. The seeds need not be taken out, they will do no harm. They can be stored for months, but should not be fed if bruised or decayed.

Oats, Green.—Where available green oats or green feed from other grains may be used for poultry feeding. They all contain vitamins. They should only be fed when young and succulent and not when fibrous and old. Green feeds of this type should be cut in a green food cutter.

Oats, Sprouts.—Where absolutely no succulent green feed or dry leaf meal is available oats may be sprouted in an oat sprouter and fed to poultry as a succulent and vitamin feed.

The sprouts should be fed when green and about 3 inches high. Feed 1 to 2 square inches of the germinated oats and green shoots per hen.

Onions.—As a succulent green feed onions and green onion tops may be fed to poultry and have a beneficial effect on the system. They are especially valuable for brooder chicks on cold days or when they need a little cheering up. Too much must not be fed to laying stock, otherwise they may taint the eggs. Self-multiplying onions are the best to grow.

Paw-paw Leaves.—Paw-paw leaves have been shown to possess considerable feeding value, being high in protein and carbohydrates. They are fairly palatable to poultry, and as they are green in winter and easily grown anywhere in this country, they may be used if necessary. The leaves may be made into a dry leaf meal in a similar fashion to sunflower leaf meal for addition to the mash if desired. Paw-paw leaves are probably highly digestible and high in Vitamin "A."

Potato.—This crop is not generally fed and is not a vitamin supplement of any value. Where it is desired to use them they should be boiled and mixed with mash. They are a fattening feed and should not be fed to any extent, except for that purpose.

Pumpkin.—Like the melon, this feed is grown extensively and may be used as a succulent feed. It contains Vitamin "A." The same remarks apply to pumpkins as for melons.

Rape.—Where it is grown rape and kale form excellent greens for poultry. Rich in Vitamins "A," they may add variety to the green food rations. Containing more green leaf they are preferable to cabbage.

Sunflower Leaf.—The leaves of the sunflower plant may be plucked, chopped and fed to poultry as greens. Being somewhat coarse they are better suited to adult stock. They will contain Vitamin "A."

Swiss Chard (Spinach Beet).—This crop is an excellent one for poultry. It is a perennial and a heavy cropper. The leaves only are fed and form a soft succulent green fed rich in Vitamin "A." It is an excellent crop for winter greens and is most palatable.

Other Greens.—If birds will eat the chopped green food almost any greens are suitable from a Vitamin "A" point of view. To get birds used to a change in greens mix with a little wet mash for a while. At times such greens as "M'sasa" tree leaves and willow leaves have been fed and are certainly better than no greens at all.

MISCELLANEOUS FEEDS.

In this class we have such essentials in the diet of poultry which are not strictly feeds, but are necessary for health and production.

Oyster Shell.—Chickens growing very quickly and hens laying a considerable quantity of eggs cannot get sufficient calcium from their usual feed to satisfy their requirements, therefore additional calcium is supplied to them in various forms, one of the commonest and best being ground oyster shell. Oyster shell or a suitable substitute should be available to all poultry, and more especially laying hens, at all times. Oyster shell should contain 95% carbonate of lime.

Marine Shell.—Mixed marine shell is probably used to a larger extent than oyster shell in this country for the same purpose as it is cheaper. However, mixed marine shell as a rule does not contain as much carbonate of lime as oyster shell and may often have other impurities which may make it more expensive than good oyster shell. It is frequently mixed with grit and sold as shell grit.

Limestone (ground).—In order to be sure that all birds are receiving adequate lime in the ration ground limestone is often added to the mash feed. This is a desirable practice. As a substitute fine oyster shell or marine shell may be used in the mash. The price and lime content of these feeds should determine which is to be used in each case. 1% of fine shell or ground limestone in the mash is desirable.

Phosphates.—Phosphorus is necessary to all poultry and must be added to the usual feed by means of a suitable supplement. The usual supplement to ensure an adequate supply of phosphorus is bone meal, which has been discussed elsewhere. Another supplement used in ground phosphate.

It should be borne in mind that lime and phosphates cannot be stored or made use of by stock without the co-operation of Vitamin "D," or the ultra-violet light of direct sunlight.

Salt (common).—Common salt supplies both sodium and chlorine, which are both required in small amounts by poultry. Salt also makes a feed more palatable and aids the digestion. If consumed by poultry in too large a quantity, however, it is injurious. About $\frac{1}{2}$ to 1% in the mash is considered sufficient.

Sulphur.—Frequently it is recommended that sulphur should be added to the feed of hens, and in certain treatments for blood disorders and during the moult; it is useful, however, there is sufficient sulphur in the average feed for the requirements of birds. Sulphur carrying proteins should be used when it is desired to give extra sulphur. Milk albumen is the best source available.

Charcoal.—There is no necessity to feed charcoal, but it is considered an intestinal corrective and may be fed as such. It may be included in the mash at the rate of $\frac{1}{2}$ % and placed in hoppers for the birds to help themselves.

Grit.—The function of grit is to act as the birds' teeth to do the crushing and grinding of feed in the gizzard. Therefore the most desirable quality in grit is its hardness. It is usual to have grit available in suitable sizes for all stock, and more especially to birds confined in intensive houses.

Condiments.—Various condiments such as mustard, pepper and proprietary articles are fed to stimulate egg production. At times they may stimulate production, but it is considered an artificial reaction and the use of stimulants is questionable. They should be used in practice with great moderation only, supplying sufficient to season the mash. They should never be fed as a regular practice.

Water.—All classes of stock require an abundant and continual supply of cool, clean, pure water, except where skim milk is fed as the sole protein supplement to the grains when it furnishes the water requirements. Where there is any doubt about the purity of the water it should be tested for impurities. The water must be kept out of the sun and in clean vessels. It must be renewed at least once daily.

HOW TO USE THE FEEDS.

Having discussed the various feeds available for poultry in this country the next step is for the farmer to know how to use them in order to produce the desired result. It must be emphasised here that there is no one best ration applicable to all farmers. The best ration for each individual farmer is that which produces the best results at the minimum cost of production on his farm.

Maintenance.—Before egg production, growth or fat can be provided the bare maintenance of the bird must be fully satisfied. About three-quarter of the feed taken in is for this purpose and only a surplus goes to the extras. Maintenance requirements are for heat, energy and repairs to the body tissues, etc. Where a ration is inadequate, production and not maintenance is the first to suffer, as self-preservation is the first law of nature. Feeders of all classes of stock would do well to bear this fact in mind. No profit comes directly from the maintenance of the body, but unless it is satisfied no profit can be expected from the little extra which goes to form eggs or meat.

Definition of Terms.—In order to understand how to furnish the feeds in the correct proportions it is necessary to know something about their composition and digestibility. This is supplied in the accompanying table and refers to the amount of digestible nutrients available in the various feeds as far as poultry are concerned.

A balanced ration is one that consists of the proper nutrients in the right amounts for the purposes intended.

A nutrient is any constituent of a feed that produces heat and energy or builds body tissue.

Feeds are composed of water and dry matter, but not sufficient water for the body needs, therefore it must be supplied. Dry matter is composed of organic and inorganic substances. The organic material is combustible and consists of sugars, starch, fat, protein and fibre. The inorganic substance is composed of minerals and ash.

The protein is chiefly concerned in the making of lean meat, nerves and feathers in the fowl and the albumen or

white of the egg. It is essential for egg production and growth. No nutrient will take its place, and it is generally the most expensive part of the feed.

The source of the protein is of importance in balancing the cereal grains which make up for the most part the carbohydrates in the feed. However, it is not the protein that is of such importance but the amino-acids composing it. A vegetable protein is no less and no more valuable than an animal protein carrying the same amino-acids. It has been shown that protein from vegetable sources carrying the correct amino-acids could partly or wholly replace animal protein in the ration when supplemented with minerals.

Therefore, whether vegetable protein supplements should be used partially to replace animal protein supplements will depend upon the relative prices of the digestible proteins. The emphasis as to source of the protein should not be made as between animal and vegetable but between grain and other sources.

Other factors, however, influence the selection of the protein supplement, and as supplements of animal origin such as milk products, meat and fish products, are more palatable and add variety to the ration, a proportion of one of them in the ration is usually recommended. As mentioned elsewhere the vegetable sources of protein carrying the desirable amino-acids in this country are chiefly peanut meals, soya bean meals or other legumes.

Carbohydrates include the fibre and nitrogen-free extract. The fibre is the woody or cellulose portion of plants, this the fowl can only digest to a minor degree, but a certain amount is necessary to distend the intestines and allow the digestive juices to act more thoroughly. Nitrogen free extract consists mainly of the starches and sugars and is used by the fowl to supply heat and energy, any excess being stored as fat.

Fat has the same function as nitrogen free extract, but is however more effective than starch or sugars and gives $2\frac{1}{4}$ times as much energy for each unit of weight. Digestible nutrient refers to the amount of any of the feed substances that can be assimilated by the class of stock concerned.

Poultry differ somewhat from ruminants in their ability to digest these nutrients. The digestible co-efficient of any food nutrient can only be found by actual trial, and with poultry this is difficult owing to the urine and faeces being mixed before expulsion. However, a certain amount of work has been done with poultry in Europe and U.S.A. and digestible co-efficients arrived at for the more important feeds. These have been used as far as possible, together with Rhodesian or South African analyses of feeds where available, in order to compile the "table of feeds." Where no co-efficients of digestibility are available those for a similar feed or those for other classes of stock have been taken and are as near as possible correct until more work is done on this important subject with poultry.

The nutritive ratio means the amount of digestible protein in the feed or ration as compared with the combined digestible carbohydrates and fat. A nutritive ratio (or N.R.) of 1 to 5 (or 1:5) means that the feed or ration contains one part of digestible protein to every five parts of digestible carbohydrates and fat.

The total digestible nutrient (or T.D.N.) is found by multiplying the digestible fat in the feed by $2\frac{1}{4}$ and adding this to the digestible carbohydrates (or nitrogen-free extract) digestible protein and digestible fibre if any in the feed.

Standard Requirements.—No very detailed standards of requirements are available for poultry as there are for other classes of farm animals, but from studying the results of successful rations the following standard requirements are considered to be fairly accurate.

Growing Chicken to 12 Weeks.—Fibre 3.5 to 5 per cent. of total food consumed. Digestible protein 15-18 per cent. of the total food consumed, of which 5-6 per cent. should be animal protein.

Total digestible nutriment 70-75 per cent. Here the nutritive ratio is 1:3 to 1:4.

Laying Hens and Chickens after 12 Weeks of Age.—Fibre 3.5 to 5 per cent. of total food consumed. Digestible protein 12 to 15 per cent., of which 4 to 5 per cent. should be animal protein.

Total digestible nutriment 70 to 75 per cent. Here the nutritive ratio is 1:4 to 1:5.

Fattening Birds.—Fibre 3.5 to 5 per cent. of total food consumed. Digestible protein 10 to 12 per cent., of which 3 to 4 per cent. should be animal protein.

Total digestible nutriment 75 to 80 per cent. Here the nutritive ratio is 1:6 to 1:7.

Rations must be compiled to conform as nearly as possible to the standard requirements as given which, of course, include maintenance. It must be emphasised that these requirements are a guide only and other feed factors must be considered before a ration which may conform to the requirements theoretically could be considered desirable. The feed factors to be considered further are:—

Variety.—A variety of feed is necessary to stimulate the appetite and increase the consumption, though sudden changes in feed are not desirable. Where nearly equal parts of grain and mash are fed a ration containing a good variety may be made up somewhat as follows:—

	Per cent.
Grain, at least two kinds	40
Ground feeds, at least three kinds	30
Animal feeds, one kind usually desirable	10
Green feeds, as large a variety as possible	15
Minerals, grit and shell	5

Palatability.—Feeds that are not palatable to poultry must not be fed to any extent. At times they can be mixed with other feeds in the mash. Feeds that are unpalatable have been mentioned under the discussion of the feedstuffs.

Wholesomeness.—Only sound, sweet feed should be utilised. Decayed or musty feeds may cause serious trouble.

Mechanical Condition.—The feed must not be too bulky or the birds will not be able to consume sufficient. If the fibre requirements are adhered to the ration should be correct in this respect. Glutinous feeds must not form too large a percentage of the mash, as they become sticky when mixed with water or the digestive juices and are not readily consumed.

Medicinal Effect.—Some feeds are laxative, notably the oil meals and wheaten bran.

Availability.—Home grown feeds should be used as far as possible. Some which alone are not satisfactory may be combined with other feeds to form a desirable ration.

Cost.—In all cases the best feed is the one that gives the most economical return, and all feeds should be considered from this view point.

Effect on Product.—Some feeds taint the eggs or flesh of the birds; they should be avoided as far as possible. These feeds are mentioned previously.

Vitamins.—The vitamins are of great importance in poultry feeding. Briefly, to be fairly safe in this respect it is only necessary to feed some succulent green feed or dried green feed to ensure ample Vitamin "A" in the ration. Allow all stock ample access to direct sunlight to enable them to receive ultra-violet light as a substitute for Vitamin "D." Luckily this is easily fulfilled in this country. If these two points are adhered to there should be no trouble from vitamin deficiencies. For a fuller description of the vitamins as they affect poultry feeding see Bulletin No. 884, Department of Agriculture, "The Vitamins in Poultry Feeding."

Computing Rations.—As an example the following laying ration has been worked out, using the table of feeds provided.

Referring to the table it is seen that 100 lbs. of wheaten bran contains 9.5 lbs. of fibre, 11.5 lbs. of digestible protein and 39.8 lbs. of total digestible nutriment. Multiplying each by $1\frac{1}{2}$ gives the amounts in 150 lbs. of wheaten bran. In a similar fashion each feed is worked out according to the amount in the ration. This gives the following proportions.

When equal parts of grain and mash are fed the totals of 100 lbs. of each must be divided by two to find the amounts in 100 lbs. of the complete ration.

The mineral mixture in this ration consisted of 50 lbs. bone meal, 20 lbs. fine salt, 20 lbs. fine marine shell, 10 lbs. of fine charcoal, of which 10 lbs. was added. As the bone meal is the only ingredient carrying food nutrients required, the amount for the minerals is calculated on 5 lbs. of bone meal being 50% of the 10 lbs. of minerals.

	Fibre.	Digestible Protein.	Total Digestible Nutrient T.D.N.
<i>Mash Mixture—</i>			
150 lbs. Bran	14.2	17.2	59.7
140 lbs. Pollard	6.58	20.44	105.7
100 lbs. Maize Meal ...	2.3	6.9	78.9
20 lbs. Lucerne leaf meal	6.0	2.0	3.3
80 lbs. Meat meal ... (50% protein).	...	36.96	56.0
10 lbs. Minerals (50% Bonemeal).	...	1.13	1.47
500 lbs. Mash mixture	29.08	84.63	305.07
100lbs. Mash mixture	5.81	16.93	61.01
<i>Grain Mixture—</i>			
400 lbs. Crushed maize	8.0	29.6	319.2
50 lbs. N'youti (munga)	3.9	4.2	38.7
50 lbs. Sunflower seed	13.9	6.7	37.1
500 lbs. Grain mixture	25.8	40.5	395.0
100 lbs. Grain mixture	5.1	8.1	79.0
add 100 lbs. Mash	5.81	16.93	61.01
200 lbs. of Ration ...	10.91	25.03	140.01
100 lbs. of Ration ...	5.4	12.51	70.0

Succulent green feed, though it contains digestible nutrients, is not as a rule taken into consideration in these calculations.

This ration then has 5.4 lbs. of fibre, 12.51 lbs. of digestible protein and 70.0 lbs. of T.D.N. for every 100 lbs. of feed.

The nutritive ratio is computed by subtracting the digestible protein from the T.D.N., thus:— $70.0 - 12.51 = 57.49$. This figure (57.49) therefore represents the digestible carbohydrates and fat. Dividing this (57.49) by the digestible protein (12.51) gives the nutritive ratio (4.6) thus:— $\frac{57.49}{12.51} = 4.6$. The nutritive ratio is therefore expressed as 1:4.6.

To calculate, if desired, the percentage of animal protein in the feed add the digestible protein of the meat meal 36.96 to that of the bone meal in the minerals 1.13 giving 38.09. This is in 500 lbs. of mash, therefore divide by 5 giving 7.62, the amount in 100 lbs. of mash. As the mash only forms half the ration this figure (7.62) must be divided by two, giving 3.81, the amount of animal protein in 100 lbs. of ration.

From the above it will be seen that this ration conforms closely to the standard requirements for laying hens given previously and may therefore be accepted as theoretically correct. As it also possesses palatability, variety, vitamins, minerals and available feeds, it may be considered complete and a balanced ration, for egg production, preferably fed in conjunction with succulent green food and, of course, water, shell, grit.

If in calculating the ration the nutritive ratio is found to be too wide for the purpose, that is to say, it contains more carbohydrates and fat to each part of protein than desirable, the amounts of one or more feeds that have wide nutritive ratios should be reduced and one or more feeds that have narrow ratios (containing a large proportion of protein) should be substituted. If on the other hand the nutritive ratio is found to be too narrow, that is, containing less carbohydrates and fat to each part of protein than desirable, the amount of one or more feeds having narrow nutritive ratios should be reduced and one or more feeds having wider nutritive ratios should be substituted. In this way after a few trials it should be possible to form a ration that will contain all the food nutrients in proper proportion and amounts for the particular class of stock to be fed.

Table of Feeds showing the Average Digestible Composition per 100 lbs. of Feed for Poultry.

Feed.	Total crude fibre. pounds.	Digestible crude protein. pounds.	Total Digestible nutriment. pounds.	Nutritive ratio 1:
Barley	4.6	8.7	71.0	7.16
Bean meal... ..	9.4	20.5	75.6	2.9
Buckwheat	10.1	6.1	63.4	9.39
Buckwheat middlings ...	4.8	24.6	75.0	2.0

Feed.	Total crude fibre. pounds.	Digestible crude protein. pounds.	Total Digestible nutriment. pounds.	Nutritive ratio 1:
Cottonseed meal... ..	11.5	27.6	67.5	1.45
Cowpeas	4.1	19.4	76.4	2.9
Gluten feed	7.1	21.6	75.4	2.5
Hominy feed	8.5	6.3	76.5	11.1
Kaffir corn... ..	2.3	7.6	76.7	9.09
Maize, whole	1.8	8.4	80.6	8.6
Maize, cracked	2.0	7.4	79.8	9.78
Maize meal	2.3	6.9	78.9	10.43
Maize and cob meal (corn and cob)	8.5	6.3	76.5	11.1
Maize germ meal	2.0	9.1	88.2	9.2
Millet, pearl (N'youti or munga)	7.8	8.4	77.4	8.4
Milo... ..	2.4	8.7	79.9	8.2
Oats... ..	10.1	9.8	62.9	5.42
Oatmeal	9.9	9.0	58.1	5.5
Pea, field... ..	5.6	20.2	90.5	3.48
Peanut meal with shell (not extracted)	12.5	17.1	93.6	4.47
Peanut meal (kernels) ...	2.5	29.4	133.9	3.5
Peanut meal extracted (unshelled nuts) ...	4.5	40.3	83.5	1.1
Pollard	4.7	14.6	75.5	4.0
Rice... ..	9.6	5.7	62.0	9.88
Soya bean meal (not extracted)... ..	4.3	33.2	94.1	1.8
Soya bean meal (extracted)	5.5	34.7	72.5	1.09
Sunflower seeds	27.9	13.5	74.3	4.5
Sunflower head meal (no seeds)	14.19	6.86	60.4	7.4
Sunflower head meal (with seeds)	20.52	10.25	72.96	6.3
Wheat	2.2	8.7	73.5	7.45
Wheat bran	9.5	11.5	39.8	2.46
Wheat feed	7.6	12.9	64.2	4.0
Wheat screenings	7.4	9.6	62.3	5.5

Feeds of Animal Origin.

Feed.	Total crude fibre. pounds.	Digestible crude protein. pounds.	Total Digestible nutriment. pounds.	Nutritive ratio 1:
Blood meal	72.6	76.8	0.06
Blood (dried or fresh)	62.10	97.07	0.5
Bone meal	22.6	29.4	0.3
Bone, fresh cut	18.3	73.4	3.0
Buttermilk	3.4	8.4	1.5
Crayfish meal	36.0	62.4	0.6
Fish meal...	56.1	72.6	0.4
Locust meal	10.81	44.47	93.9	1.0
Meat meal (high grade)...	54.2	78.0	0.44
Meat meal (50% protein)	46.2	70.0	0.5
<i>Average—</i>				
Meat and bone meal	2.1	36.6	64.2	0.7
Meat, fresh	18.5	26.6	0.4
Meat, dried	60.2	92.3	0.4
Milk, separated	3.6	9.2	1.6
Whey	0.8	6.2	7.8

Succulent Green Feeds, Roots, etc.

Cabbage	0.9	1.9	7.1	2.7
Cactus, spineless... ..	2.3	0.4	9.7	23.2
Carrots... ..	1.2	1.9	7.2	2.5
Lucerne... ..	7.0	3.3	11.7	2.5
Mangels... ..	0.8	0.8	6.7	7.4
Melon, cattle (majorda)	1.4	0.3	4.8	15.0
Oats, green	1.7	3.4	7.5	1.2
Oats, sprouts	3.7	2.4	15.8	5.6
Potato	0.4	1.0	15.7	14.7
Pumpkin	1.3	1.1	6.7	5.1
Rape	2.6	2.6	11.0	3.2
Sunflower leaf... ..	1.97	3.12	14.2	3.4
Swiss chard or spinach beet	2.9	3.1	7.1	1.2

Dry Leaf Meals.

Feed.	Total crude fibre. pounds.	Digestible crude protein. pounds.	Total Digestible nutriment. pounds.	Nutritive ratio 1:
Lucerne meal	30.1	10.2	16.8	0.6
Paw-paw leaf meal	9.7	18.5	64.3	2.8
Sunflower leaf meal ...	7.87	12.5	26.6	1.2

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Domestic Water Supplies and Sanitation on the Farm.

By P. H. HAVILAND, B.Sc. (Eng.), A.M.I.C.E.,
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(Continued.)

Storage Tanks and Reservoirs.—The amount of storage necessary is contingent on the aspects of each particular scheme. In the case of pumping by means of a windmill, as has been previously stated, it is advisable to allow storage sufficient for windmill delivery of up to seven days. If motive power is obtained from an engine requiring continuous attention while running, it will be convenient to pump only every three or four days to reduce operating expenses, and storage must therefore be provided sufficient for the demands for that period, together with an extra supply in case of breakdown. Where water is delivered continuously, as by gravitation or a hydraulic ram, very little storage is necessary, and a reservoir or tank need only be installed to act as a stabiliser for flow of water through the distribution system; but here again it is advisable to keep a surplus storage as a precaution in case of failure in operation. As a rule a storage for a three days' supply should be provided.

The tanks or reservoirs may be constructed of various materials—iron, brick, concrete or masonry. The following tables give the dimensions of tanks and reservoirs for various capacities:—

Stock Sizes of Circular Corrugated Galvanised Iron Tanks.

Capacity (gallons).	Height. (feet).	Diameter.
500	6	4ft. 3in.
1,000	6	5ft. 10in.
1,500	8	7ft. 6in.
2,000	8	9ft. 0in.

Inside Diameters of Circular Reservoirs (6ft. deep).

Capacity (gallons).	Inside Diameter.
5,000	13ft. 0in.
10,000	18ft. 5in.
15,000	22ft. 7in.
20,000	26ft. 1in.
25,000	29ft. 2in.

Inside Dimensions of Square Reservoirs (6ft. deep).

Capacity (gallons).	Inside Dimensions.
5,000	11ft. 7in. x 11ft. 7in.
10,000	16ft. 4in. x 16ft. 4in.
15,000	20ft. 0in. x 20ft. 0in.
20,000	23ft. 1in. x 23ft. 1in.
25,000	25ft. 10in. x 25ft. 10in.

Iron Tanks.—The most usual type is the circular corrugated galvanised iron, which is obtainable in various sizes. As a rule these tanks, particularly in the case of the smaller sizes, are made of ordinary galvanised iron, but ingot iron is strongly recommended. Up to 2,000 gallons capacity the thickness of iron usually used in the sides is No. 24 S.W.G. (standard wire gauge); the bottoms should be of No. 22 gauge. Up to 5,000 gallon the sides are of No. 22 gauge and the bottoms of No. 20 gauge. It is better to use for 5,000 gallon sizes iron of No. 20 gauge throughout.

The tops of large tanks should be reinforced with an angle iron ring to give rigidity. All tanks should be coated inside and outside with some anti-corrosive paint, such as a bitumastic solution. It is very advisable to have the tanks mosquito-proofed, and care must be taken to see that both the inlet and overflow pipes are protected. The overflow pipe may be suitably protected by carrying the end inside the tank below the surface of the water, as shown in Figure X. It is advisable to have a scour valve placed at the bottom of the tank for cleansing purposes, but, where convenient, the outlet pipe may be utilised for this. Rectangular metal tanks may also be used, constructed of flat plates, but as a rule these are not suited to small farm supplies on account of their

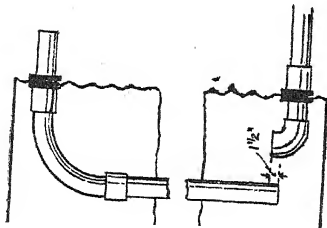
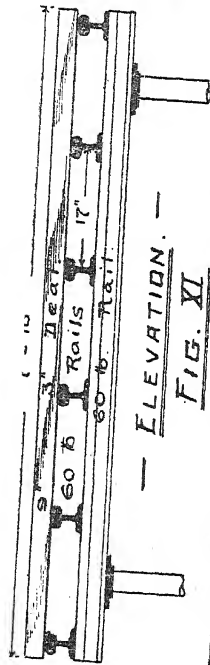


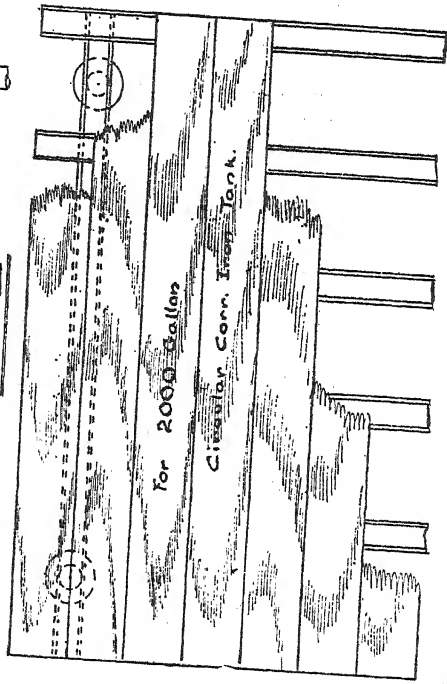
FIG. X

PAVED OVERFLOW

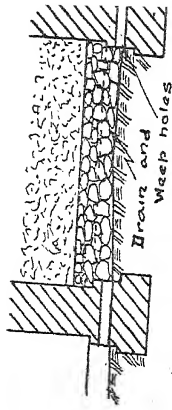
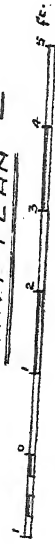


ELEVATION.

FIG. XI



PART PLAN



SECTION AA

FIG. XII

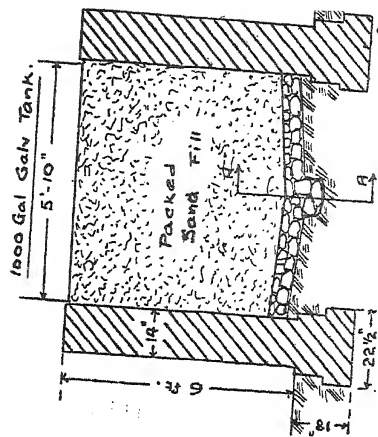


Fig. XII

high cost. Should they be installed, however, it may be noted that the leakage which usually occurs immediately after erection will cease as the joints take up.

There are several forms of tank stands which may be utilised for carrying circular metal tanks. Where a tank is required to be set at a fairly high elevation—from, say, 8 feet to 25 feet—the most suitable type of stand is the tubular. This consists of uprights of piping stayed with smaller horizontal pipes and braced with round mild steel diagonals.

The top of the stand may consist of iron rails; second-hand 60 lb. are suitable, with deals laid on top. (See Figure XI.).

The sizes of pipes to be used depend upon the capacity of the tank to be carried, and may be safely left to commercial firms supplying this type of stand. A badly made stand of this type is unsafe, and the farmer would be advised to purchase ready for erection.

For tank stands up to 6 feet or 7 feet in height, brick, masonry or concrete may be used. The stand may be either solid or hollow. The latter type is very effective. A circular stand consisting of a ring of brick work or masonry set in cement with sand or rubble filling is recommended. If sand filling is used it is advisable to make the inside diameter of the ring slightly larger than the diameter of the tank. The reason for this is that in the event of the sand filling settling down, it will not leave the tank supported only round its circumference, as might occur if the tank overlapped the brick or masonry ring.

It is advisable to place a drain at the bottom of the stand to drain all water away from the filling. The sand, which must be clean and free from clay or vegetable matter, should be placed with water in order to effect as full consolidation as possible. The sand is dumped in dry and then well soaked with water, care being taken to see that the water had passed right through. The whole is then left to dry undisturbed. Figure XII. shows a tank stand of this type, and a detail of the drain construction is also given. The brickwork ring must be 14 inches thick at least and should rest on a footing of 22-inch brickwork carried 12 to 18 inches below ground surface.

In place of sand, broken rubble filling may be used. The rubble may consist of broken stone, hard, well-burnt brick, furnace cinder, etc. It must be well consolidated by tamping and should be topped off level with the ring by means of a layer of 1.4.8 concrete with cement plaster finish.

The concrete is made up as follows:—

1 part by volume of cement.

4 parts by volume of clean sharp river sand.

8 parts by volume of clean sharp stone broken to pass a ring of 1 inch diameter.

Consolidation is absolutely necessary to prevent settlement occurring later, but a drain is not required.

Where a very low tank stand is required, these methods may also be used, but up to 2 feet in height a corrugated iron ring sand-filled may be used instead of brickwork or masonry. This ring will have to be of larger diameter than the tank. A drain is necessary for this.

A very useful fitting to any tank is a "depth tell-tale," enabling the depth of water in the tank to be seen at once by means of a pointer on a cord.

The appearance of tank stands may be improved by growing varieties of light creepers on trellis work round about, but heavy creepers which may work their way into crevices in the masonry or brickwork must be avoided.

Brick Tanks.—Full details of method of constructing three different types of water tanks suitable for use on the farm are available in Bulletin No. 900. "Three Types of Water Tank."

Purification of Water.—As has been previously stated, no water can be considered as fit for domestic consumption unless it has been proved so by means of bacteriological and chemical analyses. Flood waters which may be potable are very often discoloured by silt held in suspension, and other waters also frequently contain solids in suspension. These should be got rid of before the water is consumed. There are various methods of purification of water, such as filters and addition of chemicals, but, should any of these methods prove too costly to adopt, water should be boiled for a period of not less than

15 minutes. In order to ensure that complete sterilisation is effected, it is best to bring the water to boiling point and then allow it to stand and cool off for a period, after which continual boiling for 15 minutes should be carried out.

Domestic Filters.—The ordinary small domestic sand filter is very effective in removing solids held in suspension, but must never be relied upon as a germ-destroying apparatus nor as a means of getting rid of mineral salts in solution. The action of these filters is purely screening. They promote purity, but are no excuse for the consumption of contaminated water. Figure XIII. shows a small filter of this type constructed of concrete, capable of supplying about 300 gallons in 24 hours, with a clear water tank below. If the water contains sediment so fine that it is not able to be filtered out, chemicals may be added to the water before it enters the filter in order to cause precipitation or coagulation. The chemicals usually added are alum and lime or sodium carbonate; about 4 to 6 grains of alum per gallon is usual, but it is inadvisable to use any chemicals without first obtaining expert advice.

Slow sand filters of the large type, if constructed properly, are effective in removing bacteria. After water has been passed through for some time at a slow rate, a scum or mat of gelatinous substance is formed on top of the sand. In this, bacteria, algae, protozoa, etc., are entangled, and this mass of organisms, together with the air, effects the destruction of organic matter. Water-logging of the filter must be avoided, as this prevents aeration, and the purification is carried out chiefly by aerobic organisms requiring air. The rate of filtration must not exceed 4 inches per hour or 450 gallons per square yard of filter surface in 24 hours. The gelatinous mat must be removed at intervals, or otherwise the amount of water passing through in a given time will be greatly diminished. The period between removals depends on the quality of the water being filtered. After the mat is removed the sand must be washed in purified water and then replaced. Water should then be passed through for two or three days and allowed to run to waste, after which period the new mat will commence to function. On this account it will be necessary to duplicate the filters. The top layer of sand is the most important and should consist of sand which is wholly

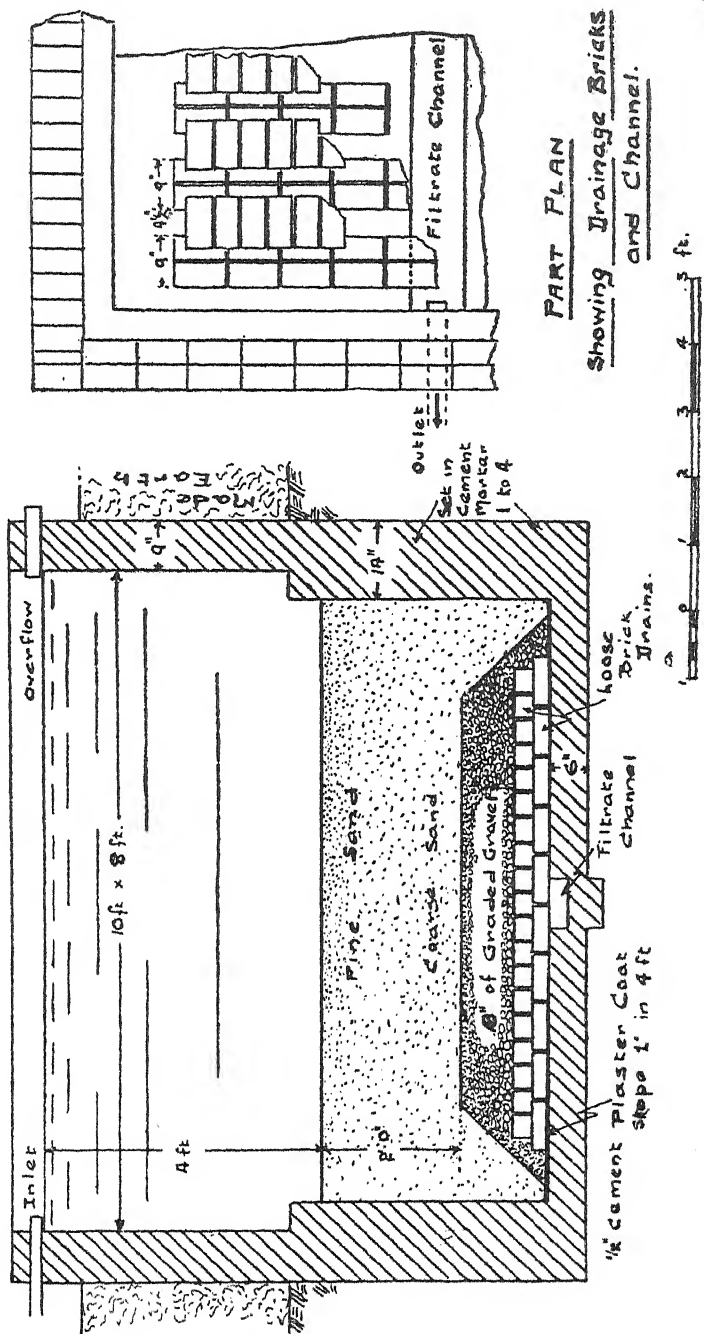


Fig. XIII.

free from any clay, vegetable or organic matters. It must be well washed first. The lower sand beds contain grains larger in size than those above. Each layer should consist of grains of a diameter slightly less than three times the diameter of grains in the bed immediately above. The grains in the layer at the bottom must be sufficiently large to prevent them passing through the drains. Figure XIV. shows a slow sand filter capable of supplying about 4,000 gallons in 24 hours, but farmers are advised to obtain advice from this branch before installing large slow sand filters. Other filters of the mechanical, pressure or gravity type are obtainable, and these are very efficient, the only drawback being the somewhat high price. Sizes suitable for small quantities of water are obtainable. There are many proprietary makes of small domestic filters on the market made of a great variety of materials and adapted to fit direct to taps and to operate separately. The farmer is warned against the use of any make which has not been definitely proved to be effective. In general, filters containing cloth, sponge, paper, asbestos, charcoal or similar materials are to be avoided. In these types bacteria may easily increase in number in a very short time and be passed through the filter, thus polluting the supply of what should be pure water. The only filters which have been proved to be capable of retaining bacteria are of the Pasteur-Chamberland and similar types. This type contains "candles" or tubes of porcelain, through which filtration is effected, the water passing into the "candle" from the outside. The disadvantage of this filter is the slow speed of operation, which is only about half a gallon per tube per day without pressure and about 6 gallons per day with pressure. The Berkefeld filter is a similar type, and filtration is effected through infusorial earth or "kieselguhr." This filter should be sterilised daily.

Sterilisation.—Water may be rendered fit for potable purposes by sterilisation. The best method is undoubtedly by thorough boiling, but in the case of large demands this is not a practical proposition, and consequently other methods are adopted.

Chloride of Lime.—Make up a stock solution by dissolving 3 tablespoonfuls of fresh chloride of lime (bleaching powder)



PART PLAN
Showing Drainage Bricks
and Channel.

Rev. 8.1.11.

Fig. XIV.

in $2\frac{1}{2}$ quarts of water. This solution should be kept in a glass stoppered bottle. The bottles sold by any chemists as "Winchester Quart Bottles" hold approximately $2\frac{1}{2}$ quarts, and these will prove very suitable for keeping the stock solution in. This solution gradually loses its strength, and so fresh solutions should be made up occasionally. For sterilisation, add 3 teaspoonfuls of the stock solution to each 5 gallons of water, mix thoroughly and allow it to stand for 30 minutes, after which the water will be fit to drink.

Tincture of Iodine.—The ordinary tincture of iodine containing about $2\frac{1}{2}$ per cent. of iodine may also be used for sterilisation. To 1 gallon of water 4 drops of tincture must be added and mixed in, and the water will be fit for consumption 30 minutes afterwards.

Sterilisation while Travelling.—In this country there is a great tendency when travelling to drink any water, irrespective of the source from which it comes. This is an exceedingly bad practice for which there is no excuse, and the sufferers from disease contracted in this manner have only themselves to blame. Preparations put up in tabloid form, which are most effective as sterilising agents, are obtainable locally. In some of these the water after treatment has an acid taste (citric acid), which is not unpalatable. In others there is no taste at all after treatment. For carrying about while on a journey they are extremely useful, occupy practically no space and take a very short time to effect sterilisation. The farmer is strongly advised to keep a bottle or container of these in the house.

Forestry in Southern Rhodesia.

Statement prepared by E. J. KELLY-EDWARDS, Chief Forest Officer, Southern Rhodesia, for the Fourth Empire Forestry Conference held in the Union of South Africa, September-October, 1935.

Continued

PART 4.

BRIEF NOTES ON MOST IMPORTANT TIMBERS.

In addition to the uses of timbers enumerated in the 1920 Statement, it may be mentioned that the timber of umgusu or so-called "Rhodesian Teak" (*Baikia plurijuga*) is much used for railway sleepers and parquet flooring.

Certain exotic hardwoods grown in the Colony are now being used for mining and rough building purposes—the more common timbers being of *Eucalyptus saligna*, *E. botryoides*, *E. tereticornis*, *E. rostrata*, *E. punctata* and *E. paniculata*. Eucalypts are also extensively grown to replace the dwindling supplies of indigenous fuel used in tobacco curing.

Plantations of exotic conifers for the production of softwoods are still too young to allow of exploitation. The following trees may be grown with success in suitable localities:—(a) In the moist zone of closed forests:—*Pinus radiata* (*insignis*), *P. patula*, *P. longifolia*, *P. canariensis*, *P. caribæa*, *Cupressus lusitanica*, *C. macrocarpa*, *C. torulosa*, *Cryptomeria japonica*. (b) In the tree-veld zones of higher rainfall:—*Cupressus torulosa*, *Callitris calcarata*, *C. glauca*, *Pinus longifolia* and *P. radiata*.

PART 5.

OWNERSHIP OF FORESTS.

By Order-in-Council and by the Land Apportionment Act of 1930, land in Southern Rhodesia is divided into European Area, Native Reserves, Native Purchase Areas, Forest Area and certain Undetermined and Unassigned Areas.

In the European Area land may be alienated under either the "Gold Belt" or "Non-Gold Belt" title. Under the former title timber, except that taken for domestic or farming purposes, is reserved to the State, but miners and prospectors may take such timber for mining purposes, free of charge.

Of the Colony's 150,354 square miles Native Reserves occupy 33,742 square miles and Alienated Land about 50,495 square miles.

As a large portion of accessible forest occurs in the gold belt area, and, in view of the present difficulty of differentiating between State and other forest, it is considered advisable for the purposes of this Statement to group all forest, with the exception of private plantations of exotic trees, under joint ownership.

Certain areas are definitely dedicated to timber production by the State, while others, representing National Parks and Game Reserves, which are administered by the Forest Authority, are, in effect, also forest reserves.

The progress in dedication, since 1920, is as follows:—

Year.	Acres. Area Dedicated.	Acres. Progressive Total.
1920	112	112
1922	13,137	13,249
1926	2,361	15,610
1927	18,420	34,030
1929	632,385	666,415
Total	666,415 acres or	1,041 square miles

The effect of these dedications is that the State is directly interested in afforestation or conservation in the three main climatic zones of the Colony in the following proportions:—

Under 30 inches rainfall typical of Kalahari sand formation	590,500 acres
30 to 40 inches rainfall in zone mainly occupied by Europeans	15,610 acres
Over 40 inches rainfall in zone suited to soft- wood production	60,305 acres

In addition to the foregoing areas, the Forest Service is engaged in the protection of 95,000 acres of unreserved forest and of 3,698,000 acres of National Parks and Game Reserves.

Private enterprise in the form of Municipalities, mining and land companies, and the farming community are actively engaged in conservation of indigenous timber or afforestation, with the result that, for the year 1933, it is estimated that there were in existence over 3,000 acres of conifer and over 13,200 acres of broadleaved plantations.

Table II.—Forest Area by Ownership.
(In square miles.)

Type of Forest.	The State. Dedicated to Timber Production.	Other Forest, State and Private.	Private Plantations.	Total.
Merchantable ...	575	21,618	11	22,204
Unprofitable or inaccessible	466	66,127	12	66,605
Total	1,041	87,745	23	88,809
Percentage of total forest area	1.17	98.80	.03	100%

PART 6.

THE RELATIONSHIP OF THE STATE TO THE FORESTS.

A.—SUMMARY OF EXISTING LEGISLATION.

In 1920 the territory of Southern Rhodesia was administered by the British South Africa Company under Royal Charter, but in 1923 the Colony was granted Responsible Government. In addition to the laws in existence at the time of the 1920 Statement, the following laws affecting forests have been passed:—

The “Native Reserves Forest Produce Act, 1929” is an important enactment regulating forests and forest plantations in Native Reserves.

The “Land Apportionment Act, 1930” sets aside certain scheduled “Forest Areas” which are reserved for afforestation

purposes. Regulations framed under this Act are also in force regulating the disposal of forest produce in Native (Purchase) Areas.

Amending Acts to a Land Tax Act, which taxes certain unimproved land, exclude from taxation every fifty morgen of land for every morgen planted to growing forest trees, and also indigenous forest land in respect of which the owner takes approved measures for the protection and conservation of trees wood and arboreal products, or for the prevention of erosion or for the conservation of water supplies.

Laws affecting National Parks and Game Reserves make provision for the protection of forest and other vegetation.

A general Forest Act for the Colony is necessary and is receiving consideration.

B.—BRIEF SUMMARY OF DIRECT ADMINISTRATIVE METHODS OF FOREST DEVELOPMENT.

In the largest State forest reserves, which total 590,500 acres of *Baikiea plurijuga* (Rhodesian "Teak") forest and in 95,000 acres of unreserved forest of similar type—all of which occur on the Kalahari sand formation in the north-west of the Colony, fire protection is the main operation of the Forest Service. These forests are endowed with remarkable regenerative powers from coppice, sucker and seed, but through the action of periodic fires they have been reduced to probably at least one-twentieth of their normal yield capacity.

Since 1925 a system of fireguards for localising outbreaks, combined with patrol and the maintenance of a fire fighting force, has resulted in the diminution of fires to a remarkable degree, and has allowed millions of young trees to pass through the stage when they are most vulnerable. Over vast areas rigid exclusion of fires is impracticable and uneconomic if repeatedly annually, but it is probable that methods of control burning which are now in course of elaboration will bring about the desired results.

In the Kalahari sand areas fire protection is equivalent to reforestation.

Afforestation with hardy exotic broadleaved and coniferous species is being carried out in the Midlands of the

Colony to the extent of about 150 acres per annum in the proportion of 2:1.

In the high rainfall areas of the Eastern border, which are well suited to the growing of both broadleaved and coniferous species, afforestation is more extensive, especially with the production of softwoods. From 1929 to 1933 the annual planting was 540 acres, of which 515 acres comprised conifers.

As has been pointed out already, all types of open forest have vigorous powers of reproduction either from seed, sucker or coppice growth. Fire is the main menace, especially in the young stages. Efforts are concentrated on the exclusion of this handicap, and many years must elapse before the more usual methods of silvicultural treatment can be taken in hand.

Since 1925 afforestation operations have been used for the relief of European unemployment. Camps are maintained as separate working units on forest reserves, and the men are employed as labourers at wages up to 5s. per diem in the general duties connected with afforestation. The system is purely a relief measure, and acts as a refuge until such time as the men are able to secure employment in their normal trades.

The numbers of men engaged in relief operations are as follows:—1925, 39; 1926, 56; 1927, 70; 1928, 79; 1929, 120; 1930, 149; 1931, 197; 1932, 200; 1933, 173.

C.—BRIEF SUMMARY OF ASSISTANCE GIVEN TO FORESTRY.

Apart from nurseries at field stations where afforestation is in progress, the State has maintained for many years a Forest Nursery at the Capital, Salisbury. This nursery disposes, by sale at low prices or by *gratis* issues, of about 200,000 forest tree transplants, 33,000 hedge plants and shrubs and 220 lbs. of seed each year to the farming community and general public.

Expert advice is given freely by Forest Service officials, either by correspondence, by publications in the *Rhodesia Agricultural Journal*, by periodic tours through the farming districts or by addresses at meetings.

The form of remission of taxation is described under "Legislation," above.

PART 7.

THE FOREST AUTHORITY.

Organisation.—The “Forestry Division” is a branch of the Department of Agriculture, under the Minister of Agriculture and Lands. The European *personnel* comprises the Chief of the Division, who is also Chief Forest Officer, four District Forest Officers, a Manager of the Salisbury Forest Nursery, seven Foresters, a Game Warden, a Curator of the Victoria Falls Reserve, three Foremen, an Apprentice and a Clerk.

The Colony is divided into four forestal districts, each under the control of a District Forest Officer, stationed in his district. The Forest Reserves are controlled by these officers and are divided into patrols under the charge of Foresters, who, in turn, are assisted by Foremen and Apprentices.

The native staff is composed of rangers and labourers.

The European Unemployment Relief Camps are under the direct supervision of Foresters responsible to their local District Forest Officers.

In 1933 a Forest Officer was appointed by the Native Reserves Trust for the Native Reserves which are set apart for the sole and exclusive use of the native inhabitants of the Colony. The duties of this officer, who is under the technical guidance of the Chief Forest Officer, are (a) to introduce and supervise measures for conserving and efficiently utilising the indigenous forests in Native Reserves, (b) to introduce fast growing exotic trees where indigenous resources are inadequate, and (c) to supervise and arrange for the sale of forest produce.

It may be mentioned that all revenue accruing from the sales of Native Reserves forest produce is paid to the credit of the Native Reserves Trust Fund.

Powers and Duties.—The Division of Forestry is responsible for:—

1. The administration, management and protection of all State forests, game reserves and national parks.

2. The survey and study of the natural forest wealth of the country, the study of forest ecology and the mapping of data collected.
3. The investigation of indigenous forest products and the finding of markets for them.
4. The investigation and study of introduced exotic trees.
5. The distribution from Government nurseries of seeds and transplants of forest trees.
6. The investigation into the seasoning and preservation of timber.
7. Advice to Government, Government Departments and the public on all matters appertaining to forestry.
8. Propaganda for general afforestation with suitable indigenous and exotic trees, with the object of supplying the Colony's requirements in timber and other forest products.
9. The administration of the "Game and Fish Preservation Act, 1929," and the enforcing of existing laws and regulations relating to forests, to the cutting of timber for mining purposes and to the exploitation of forest products under forest concessions.

Income and Expenditure.—Hitherto the income of the Division of Forestry has been derived mainly from the sale of nursery stock, as plantations are still too young for exploitation. The average income is approximately £2,000 per annum. Royalties on indigenous timber are credited to the Lands Department.

For the three years ended 1933 the average annual amounts voted or spent were as follows:—

Establishment	£7,260
Travelling and transport	450
Nurseries and afforestation	6,460
Protection of indigenous forests	1,000
Game Reserves and Parks	460
Miscellaneous	170
European relief employment in forestry ...	9,840

Total £25,640

Recruitment and Training of Staff.—The Forest Officer staff is recruited from men possessing a forestry degree of a recognised British University. Preference is given to candidates with post-graduate training at the Imperial Forestry Institute, Oxford.

The Forester staff is composed of men who have received technical training at forestry schools in Great Britain and the Union of South Africa.

In 1929 a scheme was introduced which is designed to fill future appointments to the forester grade from Rhodesian youths trained in the Division of Forestry. The course occupies eight years, made up of three years apprenticeship and five years foremanship. Theoretical and practical training is given by the superior staff.

Publications.—Annual reports and bulletins of the Division of Forestry appear in the *Rhodesia Agricultural Journal* of the Department of Agriculture. From time to time articles of local forestry interest are contributed to the Press.

PART 8.

FORESTRY ACTIVITIES OF MUNICIPAL AND CORPORATE BODIES, PRIVATE COMPANIES AND PRIVATE INDIVIDUALS.

The activities under this heading reported in 1920 have been expanded by the formation of several companies and syndicates which are engaged in afforestation, mainly with fast growing exotic hardwoods. The British South Africa Company has established extensive plantations of softwoods on the Eastern border near Umtali.

The great strides made in the production of Virginia tobacco have caused many tobacco growers to establish fuel plantations.

The recorded area of plantations, other than those owned by the State, was, in 1933, 16,300 acres.

PART 9.

PROFESSIONAL AND OTHER SOCIETIES INTERESTED IN FORESTRY.

In addition to the Rhodesia Scientific Association mentioned in the 1920 Statement, a Rhodesia Arboricultural Society was formed in 1927. The Society aims at stimulating interest in all matters pertaining to forestry and, as a means to that end has organised tree planting competitions.

As a result of the recommendation in the Report of the Education Commission, 1929, that "opportunity should be taken to stimulate interest in forestry by encouraging schools to obtain an area and plant it with trees of economic value, as an endowment for the school in future," the Prince Edward School Forestry Association, Salisbury, was constituted in 1930.

The objects of the Association are:—

- (1) To promote the highest quality of citizenship and disinterested public service.
- (2) To cultivate an enlightened opinion in favour of—
 - (a) Caring for natural forests;
 - (b) Afforestation with suitable trees to supplement the indigenous supplies;
 - (c) To establish and maintain school plantations and to utilise moneys realised from the sale of the produce of such plantations for any desirable, though not essential, purposes in the school environment which do not properly fall within the Government's obligations.

This school has obtained a twenty-five year lease of fifty acres of Municipal land, which is now in process of being afforested by the boys.

PART 10.

EDUCATIONAL, RESEARCH AND EXPERIMENTAL WORK.

The instructional methods outlined in the 1920 Statement have been continued, and the various forest stations, particularly the nurseries, are used for demonstration purposes to the public interested in forestry.

As far as their administrative duties will permit, forest officers carry out rather limited laboratory work. Wherever possible the co-operation of other Divisions of the Department of Agriculture, such as the Chemistry, Entomology, Irrigation and Plant Industry, is cordially given. As far as possible the Division takes advantage of facilities afforded by the Imperial Institute, the Imperial Forestry Institute and Kew.

In field work experimental plantings are carried out both by the State and private individuals and valuable data are being collected. Arboreta of exotic and indigenous trees are progressing in various parts of the Colony.

Timber and vegetation surveys are being actively pursued by all forestry officials.

A great wealth of valuable data of all classes is recorded at the Head Office of the Division, but shortage of trained staff has so far been the drawback to tabulating and correlating the information in a form in which it will be of most benefit.

(To be continued.)

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 34. September, 1935.

During the first half of the month the Red Locust (*Nomadacris septemfasciata*, Serv.) was more in evidence than during the previous part of the dry season.

Swarms, some described as being of "enormous" size, were reported in various districts, including the following, namely:—Salisbury, Melsetter, Mazoe, Gwelo, Lomagundi, Untali, Sebungwe, Invanga, Hartley, Makoni, Bubi, Victoria, Belingwe, Chibi, Nyamandhlovu and Insiza.

After the 19th the number of swarms reported decreased greatly, and none at all were reported during the last six days of the month.

The swarms have been moving in all directions, and if the majority have left the Colony, it is not possible to state to what country they have departed.

All specimens received have been healthy. Most have shown a very pronounced red colour with the pink suffusion showing at the base of the hind wings. The testes of the males are developing, but there is no sign of ovarian development in the females as yet.

Some damage to young grass, small grain and trees has been reported in various localities.

Reports from Northern Rhodesia indicate a more favourable position than at this time last year, and on the whole the outlook for the coming season appears reasonably hopeful.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

AUGUST, 1935.

AFRICAN COAST FEVER.

Salisbury District.—The slaughter of the cattle on Sigaro farm was completed, twenty-seven cases were diagnosed. A case occurred on the farm Doune, adjoining the infected farm Nyaringondo, where the cattle had been dipping.

No cases occurred on the infected areas in Charter district.

FOOT AND MOUTH DISEASE.

No cases of this disease in the Colony.

ANTRAX.

An outbreak occurred in the Chilimanzi district with a mortality of nine. The herd, 180 head, were inoculated.

TRYPANOSOMIASIS.

Five cases in Melseffer district and one in Hartley district.

SCAB.

One flock in Selukwe district placed under licence.

TUBERCULIN TEST.

Seven bulls and twelve heifers were tested upon importation with negative results.

MALLEIN TEST.

Forty-one horses were tested upon entry; no reaction.

IMPORTATIONS.

From the Union of South Africa.—Bulls 7, heifers 12, horses 39, sheep 54.

From the Bechuanaland Protectorate.—Donkeys 16, sheep 697.

EXPORTATIONS.

To Northern Rhodesia.—Horses 2, sheep 82, goats 20.

To Portuguese East Africa.—Horses 1.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom in Cold Storage.—Chilled beef quarters, 10,530; frozen boned beef quarters, 10,340; frozen beef quarters, 152; tongues, 16,138 lbs.; livers, 29,414 lbs.; hearts, 11,412 lbs.; tails, 4,884 lbs.; skirts, 3,208 lbs.; shanks, 22,413 lbs.; kidneys, 2,338 lbs.

Meat Products.—From Liebig's Factory: Beef extract, 39,813 lbs.; beef fat, 45,200 lbs.; beef meal, 20,000 lbs.; beef powder, 54,929 lbs.; hoofs, 26,700 lbs.; horns, 13,028 lbs.; tongues, 2,880 lbs.

From Rhodesian Export and Cold Storage Company: Cow tail hair, 500 lbs.; Neat's foot oil, 3,301 lbs.

G. C. HOOPER SHARPE,

Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

SEPTEMBER, 1935.

Barometric Pressure.—The mean pressure for the month was distinctly below normal over the whole country.

Temperature.—Mean temperatures averaged about 2° above normal, the hottest periods being from the 5th to the 7th and from the 23rd to the 25th inclusive.

Rainfall.—Rain fell fairly generally over the country on the nights of the 24th and 25th, accompanied in many cases by thunder and lightning. The heaviest fall was at Bikita, where a total of .87 ins. was recorded.

SEPTEMBER, 1935.

Station.	Pressure Millibars, 8.30 a.m.	Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point Amt.	Precipitation.			Altitude (Feet)	
		Normal.	Absolute.					Mean.						Ins.	Nor- mal	No. of Days		
			Max.	Min.	Max.	Min.	½ Max. Min.	Nor- mal.	Dry Bulb.	Wet Bulb.	%							
Angus Ranch...	...	102	51	86.4	58.8	72.6	70.9	69.3	60.0	58	54	0.70	0.14	2	...			
Belt Bridge...	965.5	102	52	87.5	60.9	74.2	...	70.7	60.3	56	53	0.25	0.18	2	1,500			
Bindura...	893.1	93	51	84.8	56.9	70.9	...	68.6	58.9	57	52	0.14	0.13	1	3,700			
Bulawayo...	870.5	92	44	82.5	54.6	68.6	67.5	67.8	54.8	45	43	0.32	0.17	2	4,426			
Chippinga...	893.9	91	49	79.1	55.8	67.5	...	69.1	58.0	56	49	1.08	0.79	6	3,685			
Enkeldoorn...	858.9	92	46	82.7	53.7	68.2	67.0	67.5	54.8	50	44	0.30	0.14	2	4,788			
Fort Victoria...	896.8	96	45	83.0	54.3	68.7	66.1	68.6	56.8	52	47	0.42	0.21	1	3,571			
Gwaai Siding...	904.9	98	37	91.2	52.1	71.7	...	71.0	59.8	52	52	0.11	0.17	2	3,278			
Gwanda...	907.0	95	45	84.1	58.5	71.3	...	68.3	52.8	50	38	0.30	0.16	4	3,229			
Gwelo...	863.5	92	47	83.6	54.3	69.0	67.4	67.7	54.9	46	44	0.47	0.17	3	4,629			
Hartley...	886.4	95	43	87.1	54.4	70.8	70.1	70.6	56.5	41	45	0.10	0.13	1	3,879			
Inyanga...	838.2	88	42	78.7	50.7	64.7	...	69.4	52.6	31	36	0.20	0.24	1	5,503			
Marandellas...	839.1	87	47	78.9	53.1	66.0	...	66.7	52.9	40	40	0.38	0.27	2	5,453			
Miami...	879.9	92	49	83.3	56.4	69.8	...	70.0	56.3	43	45	...	...	...	4,090
Mount Darwin...	908.9	97	41	86.8	55.0	70.9	...	71.1	58.5	48	49	0.37	0.06	1	3,179			
Mount Nuza...	803.3	77	43	66.3	50.4	58.4	...	60.0	50.4	53	42	0.79	...	4	6,668			
Mtoko...	879.0	92	50	82.2	58.8	70.5	...	70.3	57.6	47	48	0.50	0.02	1	4,141			
New Year's Gift...	...	100	47	85.0	55.7	70.4	...	68.2	59.6	61	54	0.56	0.25	4	2,690			
Nuanetsi...	963.3	103	48	87.9	56.8	72.4	...	71.0	62.3	64	57	0.75	0.21	1	1,581			
Plumtree...	865.0	91	44	83.1	58.3	70.7	...	68.6	53.5	43	39	0.03	0.03	1	4,549			
Que Que...	883.0	94	49	86.4	55.2	70.8	...	68.2	55.5	45	45	0.30	0.07	1	3,999			
Rusape...	863.6	91	42	82.1	50.2	66.2	...	66.8	55.1	48	45	0.8	0.14	1	4,648			
Salisbury...	855.9	92	48	82.1	54.2	68.2	66.6	68.4	54.8	42	43	0.33	0.27	2	4,885			
Shabani...	908.9	98	48	84.1	60.5	72.3	...	68.0	57.1	55	49	0.70	0.24	1	3,193			
Sinoia...	889.4	94	40	87.2	51.9	69.6	...	70.5	57.6	45	48	...	0.19	...	3,795			
Stapleford...	886.2	91	50	83.7	58.8	71.3	...	71.6	56.8	39	49	0.33	0.10	...	3,876			
Sipollo...	843.6	84	34	72.0	43.4	57.7	...	63.2	54.7	61	48	0.77	0.79	4	5,304			
Stamford...	894.5	97	48	82.5	55.1	68.8	67.4	67.3	58.2	60	52	0.41	0.43	2	3,672			
Umtali...	895.5	101	48	94.4	57.3	75.8	...	71.9	57.4	41	46	0.3	0.05	...	2,567			
Victoria Falls...	915.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wankie...	927.3	101	55	93.5	66.1	78.8	...	76.4	59.7	36	48	0.03	0.09	1	2,990			

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

- No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
- No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
- No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
- No. 634. Barley, by P. V. Samuels.
- No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
- No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
- No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
- No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
- No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
- No. 681. The Sunflower (*Helianthus Annuus*) (Revised), by S. D. Timson, M.C., Dip.Agric.
- No. 694. The Edible Canna (*Canna Edulis*), by D. E. McLoughlin.
- No. 695. The Castor Oil Plant (*Ricinus* spp.), by S. D. Timson, M.C., Dip.Agric.
- No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.
- No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
- No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
- No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
- No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
- No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
- No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
- No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
- No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

- No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
- No. 768. The Ground Nut (*Arachis hypogaea*), by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
- No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
- No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
- No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
- No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
- No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
- No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
- No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
- No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
- No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
- No. 833. Subterranean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
- No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.
- No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
- No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.
- No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.
- No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.
- No. 901. Some Notes from the Cotton Station, Gatooma, by J. E. Peat, B.Sc. (Edin.), A.I.C.T.A. (Trinidad).
- No. 932. Further Notes from Cotton Station, Gatooma, by J. E. Peat, Empire Cotton Growing Corporation.
- No. 929. A Promising Fodder Plant, by H. C. Arnold, Manager, Salisbury Experiment Station.
- No. 936. Witchweed, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.
- No. 919. Saltbush: A Winter Succulent for Sheep in Matabeleland, by D. G. Haylett, M.Sc., Ph.D., Director, Matopo School of Agriculture.
- No. 968. Notes from the Cotton Station, Gatooma, 1935, by J. E. Peat, Empire Cotton Growing Corporation.
- No. 970. Rhodes Grass for the Rhodesian Tobacco Grower, by African Explosives and Industries, Ltd.

REPORTS ON CROP EXPERIMENTS.

- No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
- No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
- No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
- No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
- No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.
- No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.
- No. 895. Salisbury Agricultural Experiment Station. Annual Report, 1931-32, by H. C. Arnold, Manager.
- No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip. Agric. (Wye), Assistant Agriculturist.
- No. 965. Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

TOBACCO.

- No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
- No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
- No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
- No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
- No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
- No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
- No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
- No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
- No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
- No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
- No. 746. The Development of the Tobacco Industry in Southern Rhodesia. A Historical Survey, by D. D. Brown, Chief Tobacco Expert.
- No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
- No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.

- No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
- No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agri.), Tobacco Adviser.
- No. 828. Seed Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.
- No. 835. Tobacco Culture—Transplanting Operations, by D. D. Brown.
- No. 839. Tobacco Experiment Station, Salisbury—Report of General Crop Experiments, by C. A. Kelsey-Harvey, Manager.
- No. 840. Curing Tobacco by the Leaf Method v. Curing on the Stalk, by W. Collingwood-Evans, B.Sc. (Agri.).
- No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.
- No. 885. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown, Chief Tobacco Officer.
- No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.
- No. 955. Annual Report of the Tobacco Branch for the year ended 31st December, 1934, by D. D. Brown, Chief Tobacco Officer.

LIVE STOCK.

- No. 624. The Construction of Dipping Tanks for Cattle (Revised).
- No. 749. Dehorn your Commercial Cattle, by W. Fleming, Stock Adviser.
- No. 801. Sheep Farming in the Melssetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melssetter District.
- No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.
- No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.
- No. 871. Some General Observations on the Feeding of Dairy Cows on a Mixed Stock Farm, by Dr. A. E. Romyn, Senior Animal Husbandry Officer.
- No. 873. The Hand-rearing of Calves, by C. A. Murray, B.Sc. (Agric.), M.Sc.
- No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
- No. 887. The Type of Chiller Steer required for Export, by A. E. Romyn, Senior Animal Husbandry Officer.
- No. 891. Fattening Bullocks for Export, by A. E. Romyn, Senior Animal Husbandry Officer.
- No. 903. The Handling, Preparation and Chilling Cattle for Export, by C. A. Murray, Lecturer in Animal Husbandry.
- No. 907. The Blackhead Persian: Its Breeding and Management in Matabeleland, by C. A. Murray, M.Sc., Lecturer in Animal Husbandry, Matopo Estate.
- No. 909. Stall Fed Chillers for the Overseas Christmas Market, by C. A. Murray, M.Sc., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.
- No. 912. Economical Winter Rations for Wintering Dairy Heifers, by C. A. Murray, M.Sc. (Agric.), Lecturer in Animal Husbandry, Matopo School of Agriculture.
- No. 916. Cowpea Hay in the Ration for Bacon Pigs, by C. A. Murray, M.Sc. (Agric.), Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station.
- No. 919. Salthush: A Winter Succulent for Sheep in Matabeleland, by D. G. Haylett, M.Sc., Ph.D., Director, Matopo School of Agriculture.
- No. 924. Raising Dairy Calves on a Limited Amount of Whole Milk, by C. A. Murray, M.Sc. Agr., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

- No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position chiefly as regards Ranching Cattle, by Dr. A. E. Romyn, Chief Animal Husbandry Officer.
- No. 944. Pig Feeding Demonstration. The use of Balanced and Unbalanced Rations for Growing Pigs, by C. A. Murray, M.Sc. (Agr.), Senior Animal Husbandry Officer I/C., Matopo School of Agriculture and Experiment Station.
- No. 945. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.
- No. 946. Economical Rations for Wintering Dairy Cattle, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.
- No. 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.
- No. 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer.

DAIRYING.

- No. 520. Treatment of Gassy Curds in Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 530. The Dairy Industry: Causes of Variation in Cream Tests, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 594. Milk Recording and its Advantages, by T. Hamilton, M.A., N.D.A., N.D.D. Introduction by J. R. Corry, B.Sc.
- No. 667. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
- No. 717. Gouda or Sweet Milk Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
- No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corey, B.Sc. (Agr.), Dairy Experts.
- No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.
- No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.
- No. 818. Farm Butter-making—Issued by the Dairy Branch.
- No. 844. Southern Rhodesia Milk Recording Scheme.
- No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.
- No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.
- No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.
- No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.
- No. 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer

VETERINARY.

- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Lt. E. W. Bevan, M.R.C.V.S.
- No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcome, M.R.C.V.S.
- No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcome, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.

- No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 666. Notes from the Veterinary Laboratory: Præmonitus—Præmunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
- No. 756. Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 760. A Note on Sheep Diseases in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer, Department of Agriculture, Salisbury.
- No. 772. Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
- No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.
- No. 866. The Treatment of Intestinal Parasites of Sheep, by J. D. Coutts, D.V.S., M.R.C.V.S.
- No. 886. A Preliminary Note on Contagious Granular Vaginitis in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Acting Director Veterinary Research.
- No. 921. Myiasis (Screw-Worm) in Cattle in Southern Rhodesia, by D. A. Lawrence, Director of Veterinary Research, and A. Cuthbertson, Entomologist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

- No. 632. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.).
- No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).
- No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorne, M.I.Mech.E.
- No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
- No. 660. Small Earthen Storage Reservoirs, by C. L. Robertson, B.Sc.
- No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
- No. 670. Irrigation Canals, by P. H. Haviland, B.Sc. (Eng.).
- No. 782. Reinforced Concrete Water Tanks, by R. Hamilton Roberts, B.Sc. (Eng.).
- No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
- No. 808. The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
- No. 811. Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
- No. 860. Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
- No. 879. Conditions Governing the Hire of Government Boring Machines.

- No. 900. Three Types of Water Tank, by R. H. Roberts, B.Sc. (Eng.), A.M.I.C.E., Assistant Irrigation Engineer.
- No. 923. Soil Erosion, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
- No. 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.
- No. 963. The Dangers of Soil Erosion and Methods of Prevention.
- No. 964. The Use of Ditchers for Constructing Contour Ridges, by C. Tapson, Devondale, Concession.
- No. 967. How to use an Engineer's or Farm Level, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).

FORESTRY.

- No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.
- No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
- No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
- No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
- No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
- No. 809. Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.
- No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.
- No. 857. Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.
- No. 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.
- No. 874. Tree Planting, by the Division of Forestry.
Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.
- No. 888. The Vegetable Ivory Palm (*Hyphæna ventricosa*), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.
- No. 927. Some Facts about Tung Oil, by R. H. Finlay, B.A., Dip. For. (Oxon), District Forest Officer.
- No. 928. Some, Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suit for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

HORTICULTURE.

- No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.
- No. 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
- No. 805. Making a Garden in Rhodesia: Hints for Beginners and New-comers, by Mrs. E. M. V. Carnegie.
- No. 814. Avocado Growing in South Africa, by Redvers J. Blatt, B.Sc., Ph.D.
- No. 821. Vegetable Growing in Southern Rhodesia—Lettuce, by G. W. Marshall, Horticulturist.
- No. 824. Vegetable Growing in Southern Rhodesia—Tomato Culture, by G. W. Marshall, Horticulturist.
- No. 829. Asparagus Culture, by G. W. Marshall, Horticulturist.
- No. 834. Celery Culture, by G. W. Marshall.
- No. 843. Vegetable Growing in Southern Rhodesia—Onion Culture, by G. W. Marshall, Horticulturist.

- No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.
- No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.
- No. 920. Citrus Fruit Growing in Rhodesia, by G. W. Marshall, Horticulturist.
- No. 960. The Rhodesian Home Orchard, by G. W. Marshall, Horticulturist.

ENTOMOLOGY AND PLANT PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
- No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
- No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
- No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
- No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
- No. 219. More Household Insects, by R. Lowe Thompson, B.A.
- No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia, by Rupert W. Jack, F.E.S.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 369. The Bean Stem Weevil, a Minor Pest of Beans, by Rupert W. Jack, F.E.S.
- No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
- No. 425. Notes from the Entomological Branch, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 450. Insect Pests of Fruits other than Citrus in Southern Rhodesia, by R. W. Jack, F.E.S.
- No. 476. Tsetse Fly—Inspection of Shangani Experimental Area, by Rupert W. Jack, F.E.S.
- No. 503. Locusts, by J. K. Chorley.
- No. 516. The Coming Campaign against Locusts, by Rupert W. Jack, F.E.S.
- No. 522. Notes on the Black Citrus Aphis, by C. B. Symes.
- No. 548. Insect Pests of Cotton, by C. B. Symes.
- No. 553. Observations on Some Injurious Markings of Oranges, by C. B. Symes.
- No. 587. Tsetse Fly in the Lomagundi District, by R. W. Jack, F.E.S.
- No. 593. Notes from the Entomological Laboratory—(1) Outbreak of Army Worm (*Glyphigma exempta*, Wlk.), (2) Cattle Myiasis: "Screw Worm," by Rupert W. Jack, F.E.S.
- No. 602. Preliminary List of Plant Diseases Recorded in Southern Rhodesia, by F. Eyles.
- No. 613. Two Diseases of the Vine, by F. Eyles, Mycologist.
- No. 639. Diseased Plants for Examination: Collecting and Despatching the Material, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
- No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc., (Lond.), A.I.C.T.A. (Trinidad).
- No. 654. Root Gallworm or Root Knot Eelworm (*Heterodera radicola*, Greef), by Rupert W. Jack, F.E.S.
- No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.

- No. 696. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.
- No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
- No. 754. "Pinking" of Maize—Report of a Preliminary Investigation, by T. K. Sansom, B.S., Plant Breeder.
- No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.S. (Lond.), A.I.C.T.A., Plant Pathologist.
- No. 788. A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
- No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
- No. 796. The Army Worm (*Laphygma exempta*, Wlk.), by Rupert W. Jack, Chief Entomologist.
- No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
- No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
- No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
- No. 847. The Lesser Tobacco Wireworms, by Rupert W. Jack, Chief Entomologist.
- No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases—3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).
- No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
- No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.
- No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
- No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
- No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.

- No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
- No. 893. Experiments with Tsetse Fly Traps against *Glossina morsitans* in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
- No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
- No. 896. A List of Plant Diseases Occurring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
- No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.
- No. 899. The Black Maize Beetle (*Heteronchus lieus* Klug), by C. B. Symes.
- No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.
- No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.
- No. 911. Screw Worm: A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.
- No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.
- No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.
- No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.
- No. 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7. Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.
- No. 942. Mycological Notes.—Seasonal Notes on Tobacco Diseases.—8. The Mosaic Mystery. 9. Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
- No. 951. Suspected "Streak" Disease of Maize. Notice to Growers. By J. C. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.
- No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.
- No. 969. The Objects and Value of Seed Treatment of Maize against *Diplodia*, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

POULTRY.

- No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.
- No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.
- No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.

- No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
- No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.
- No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.
- No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
- No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
- No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).
- No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
- No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).
- No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 918. The Moulting of Poultry: The Normal and Pullet Molt, by H. G. Wheeldon, Poultry Officer.
- No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.
- No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
- No. 966. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.

The following pamphlets can be obtained from the Poultry Expert upon application:—

- Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
- Tuberculosis, by A. Little, Poultry Expert.
- Prevention of Disease among Poultry, by A. Little, Poultry Expert.
- Preparing Birds for Show, by A. Little, Poultry Expert.
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THE RHODESIA Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant,
Department of Agriculture, Salisbury.

VOL. XXXII.]

DECEMBER, 1935.

[No. 12

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Export of Frozen Porkers.—The third consignment of frozen porkers from this Colony to the United Kingdom will be despatched during December. The slaughtering of this consignment commenced early in November, and it is expected to complete the preparation of the consignment before the end of the present month.

The response on the whole to this shipment has been poor as compared with the two previous ones, and the pigs from farmer producers have not come up to expectation. The reason for this has been given as a shortage of maize during the present season in Matabeleland.

Out of the sixty pigs still expected from farmers, it is unlikely that more than twenty will materialise. This is unfortunate, but arrangements have been made to send a

large consignment from the Matopo School of Agriculture, and some pigs have been purchased from suppliers who did not originally intend to ship pigs.

It is of special interest to note that the pigs from the Matopo Estate have been fed on different rations to test the effect of the feeds commonly available on farms in this Colony to see how they affect the palatability and firmness of the pork produced. These pigs have been divided into four groups, fed on four different typical rations. In one group the pigs received maize, separated milk and green feed. In another group maize, meat meal and green feed. In the other two groups part of the maize is replaced by cow peas or pollard.

Reports on these pigs, especially in regard to the firmness of the fat and the palatability of the pork, will be obtained from the University of Cambridge, where extensive work has been carried on recently in the carrying qualities of chilled and frozen meats generally. It is considered that this information will be a very valuable supplement to the ordinary trade reports and afford some fundamental data which will be of use in the development of the export trade.

Payment of Mining Fees to Owners of Land.—The attention of landowners is drawn to the provisions of Section 56 of the "Mines and Minerals Act, 1935," and to the regulations in connection therewith published under Chapter V. of the "Mining Regulations, 1935."

Particular attention is drawn to the provision of the regulations by which compensation shall be deemed to be forfeited if application on the prescribed form is not made before the 30th September following the year for which the application is made.

In regard to arrear claims which have accrued since the 1st April, 1929, landowners are advised that applications for arrear payments must reach the Department of Mines on or before the 31st March, 1936, after which date no applications for arrear payments other than those provided for in the regulations will be considered.

Levy on Cattle to Johannesburg.—The levy imposed on cattle exported to Johannesburg has been reduced from 10 per cent. to 5 per cent. of the net sale price from the first of December. Under Government Notice No. 759, just published, the reduced levy only extends to March 31st, 1936.

Senior Plant Pathologist visits Beira.—Dr. J. C. Hopkins, Senior Plant Pathologist, has just concluded a tour of inspection of the citrus canker area near Beira. It will be remembered that owing to the discovery of this disease in citrus trees a few miles from Beira the export of all citrus fruits to this Colony was stopped. The complete destruction of all affected trees was undertaken immediately the outbreak was discovered, and it is believed that it has been eradicated. Dr. Hopkins carried out the inspection at the request of the Administration of the Mozambique Company's Territory, and his report will be awaited with interest.

Tsetse Fly Research.—The Government has authorised the Chief Entomologist to undertake a comprehensive series of investigations regarding the bionomics of *Glossina morsitans*, the tsetse fly which infests such a large area of this Colony. These investigations were recommended by the Trypanosomiasis Committee and were planned by the Entomological Branch. Mr. W. L. Williams, B.Sc., who is well known as inspector under the Tobacco Pest Suppression Act, has been seconded to assist in the tsetse fly research, and his post as inspector has been advertised.

Make Rainy Season Compost.—With the exception of a few isolated spots in this Colony where either closed forest conditions prevail, or where the constant wash of our hillsides has been permanently preserved in closed valleys, the soils of Rhodesia exhibit a remarkable absence of plant remains of any kind. This is the root of our agricultural problem. A really good agricultural soil must contain a fair proportion of plant remains, i.e., it must be organic as well as mineral. The addition of concentrated fertilisers in any amount cannot make up for the organic deficiency. Many of our soils are

probably more deficient in plant remains than those of any other part of the world where crops are grown on any scale. Many of our soils, on account of the heavy nature of the rains, become water-logged near the surface, and while in that condition the roots of the crops are insufficiently supplied with oxygen and are exposed to decomposition products which injure the root system and retard development. The absorption rate is too slow and the evaporation rate too high. Many years ago Meister showed that 1,000 lbs. of sandy soil would only absorb 314 lbs. of water, whereas 1,000 lbs. of soil rich in plant remains would absorb 1,052 lbs. without being water-logged. The actual loss from evaporation was very much less from the latter than from the former in the same period of time. This is very easily explained. In a soil which has no plant remains the capillary action of the soil is perfectly vertical, *i.e.*, to the surface, with no horizontal barriers interposed. In a soil rich in plant refuse the capillary action is probably more horizontal than vertical. For this reason when the soils are drying out the roots in the latter case can draw water from the soils far away from the actual roots themselves by oblique or horizontal capillary action, whereas this is quite impossible when the vertical capillaries are not broken. What we are really suffering from is the absence of this "blanket" of plant refuse in the surface soils of the Colony. This absence not only accounts for poor absorption and high rate of evaporation from our surface soils but also for the poor retention of artificial fertilisers applied.

It is realised that very few farms in this country produce sufficient farm-yard manure to be of any real use, but the progress which has been made in the methods of producing composts, using nothing but old grass and other farm refuse with a sprinkling of manure, wood ash and soil, is really remarkable, and no difficulty should be experienced in providing sufficient organic manures for ordinary crop requirements, particularly on mixed farms. The method employed in India was given in the *Journal* just a year ago, but any information required will be gladly supplied by the Department of Agriculture.

Major Irrigation Works.—Preliminary work on the construction of a large earthen storage dam on the Ungusa River, situated about ten miles from Bulawayo, has been proceeding steadily since June last.

The concrete cut-off wall below river bed level has been completed and the underlying foundations rendered watertight by pumping in cement grout under pressure. The concrete diversion weir, situated about a quarter mile below the dam, which will serve as the intake for the main canal, has been almost completed and the excavations for the spillway on the right bank is also well advanced.

Tenders for the construction of the embankment itself will be called for about April next and the dam completed in time for the storage of flood water next rainy season. The dam will be capable of storing 800 acre feet (200 million gallons) and will enable 200 acres of land to be irrigated. The majority of the land commanded is Government-owned and will be divided into small holdings with about 15 to 20 acres of irrigable land on each holding, which will be leased out to suitable tenants.

In addition the Government has recently decided to proceed with the construction of the Umshandige irrigation project in The Victoria district, and an amount of £25,000 will be provided on the Estimates next year to enable the works to be commenced about June next.

Initially the dam will be constructed to a height of 96 feet, but may later be raised to 108 feet when the development of the area justifies it.

The land commanded by the dam is 62,500 acres in extent, of which some 4,000 acres are irrigable. The land commanded is situated on farms held under Agreement of Purchase or on unalienated Crown land farms, and as the irrigable land is situated in small blocks throughout the area it is considered very suitable from the point of view of settlement, as the area can be sub-divided into farms of moderate extent with about 100 acres of irrigable land in each.

As the land is situated in an area of erratic rainfall there is a demand from the existing settlers for the irrigation of some 1,200 acres of land.

The water will be utilised for growing lucerne and wheat and in addition will in certain years be required for the irrigation of summer crops during partial drought periods.

The Popotekwe scheme, on the eastern side of Victoria, also offers great potentialities for another large irrigation scheme.

The Government has provided a sum of £500 on next year's Estimates to enable the investigations on this scheme to be completed and for plans and estimates to be prepared.

A Step in Imperial Co-operation.—An important reorganisation of the constitution and work of the Imperial Economic Committee is described in a report which that body has just issued.* Though intended to be the first of a series of Annual Reports on the Committee's work, this report actually covers a period of eighteen months, during which the Hon. G. H. Ferguson, High Commissioner for Canada, has been chairman.

The Imperial Economic Committee was established ten years ago as a result of decisions reached by Governments following discussions at the Imperial Conference of 1923. Successive Imperial Conferences amended its constitution and widened its functions. Early in 1933 its constitution and functions were again surveyed by the Imperial Committee on Economic Consultation and Co-operation which met in London in pursuance of a resolution adopted at the Ottawa Conference. In April, 1933, this Investigating Committee presented its report, in which emphasis was laid on the need for Imperial co-operation both in regard to scientific investigation and economic enquiry, and a further point made that the existence of national intelligence services and agencies for market intelligence and market promotion in which co-operative action between the peoples of the Commonwealth was desirable. No attempt was made to define in detail or for all time, the field of co-operation in economic enquiry.

The committee considered the work and organisation of the Imperial Economic Committee and the statistical marketing intelligence and economic investigations conducted by the Empire Marketing Board, and finally recommended that

the Imperial Economic Committee, while continuing to discharge its former functions should take over from the Empire Marketing Board the preparation and issue of periodical market intelligence notes and world surveys of production and trade, and that it should be within the competence of the Imperial Economic Committee to make proposals to Governments in regard to other economic services and enquiries which in its view should be conducted on a co-operative basis.

The recommendations were accepted by all Governments and the Imperial Economic Committee was reconstituted with effect from the 1st October, 1933. The committee then ceased to be the responsibility of His Majesty's Government in the United Kingdom and became the responsibility of the British Commonwealth of Nations. The composition of the committee and the number of representatives of each part of the Empire are determined by agreement among the several Governments on a basis of constitutional equality. The several members of the committee are each appointed by their own Governments. Reports are addressed to all the Governments of the Empire. Finance is provided by all Governments in agreed proportions and the resulting fund is controlled not by any one Government but by all the Governments, acting through their representatives on the committee.

The present report shows how this reorganisation was effected, and how despite a very extensive change of staff the old and new work of the committee was carried through without a break.

*Imperial Economic Committee: Annual Report covering the period 1st October, 1933, to 31st March, 1935; published for the Committee by H.M. Stationery Office, price 6d. net (8d. post free).

SALES.

Agricultural Experiment Station, Salisbury

Spineless Cactus Slabs (blades) Algerian and Moscatel varieties, per 100 Slabs 5/- delivered at the Salisbury Experiment Station, or 7/6 delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns and Cactus Slabs during January and February.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbury. (Dec.-Jan.)

The Cattle and Meat Industry in Southern Rhodesia.

[The following extracts, dealing with the prospects of the chilled beef industry in Southern Rhodesia are taken from a report by Mr. F. C. Sambrook. They are based on a tour of the country lasting about three weeks in company with Mr. W. T. Gishford. As both these gentlemen are connected with a large firm dealing in meat from different parts of the Empire and have had experience in the handling of chilled beef in several parts of the world their views can be accepted as authoritative. This report was prepared at the request of the Government, and will undoubtedly be of general interest. —*Ed.*]

To take full advantage of the existing facilities for the export of chilled beef, I would recommend that the following points be carried out.

Grading and Finish.—The animals should be finished off better than in many cases is at present taking place. For this purpose the grading at the works should be standardised and never altered under any circumstances.

The definition given in Government Notice No. 473 of 26th July, 1935, Regulations under the Cattle Levy and Beef Export Bounty Act, 1935, meets the situation, with the exception of the proposed weight limits and the separation of heifer beef.

1st Grade.—Derived from animals not over 5 years of age and of good beef conformation.

The carcase should be covered with an even covering of firm white or creamy white fat and should not show any noticeable areas of dark flesh over the loins, shoulders, rounds or ribs.

The kidney fat should be well developed, the channel fat full and a fair quantity of wavy fat should be evident over the inner surface of the ribs.

There should be a liberal distribution of fat in the lean of "the eye" at the point of quartering, and the carcass should be free from mutilation, bruises and taint. It should be properly dressed and chilled and be bright and sound in condition.

Bullocks.—Fores, 130 lbs. to 200 lbs.

Hinds, 130 lbs. to 200 lbs.

Heifers.—Fores, 110 lbs. to 200 lbs.

Hinds, 110 lbs. to 200 lbs.

2nd Grade.—Beef that does not reach the standard of conformation and quality laid down for first grade chilled beef but which is otherwise, in the opinion of an Inspector, suitable for export overseas as chilled beef.

Bullocks.—Fores, 120 lbs. and up.

Hinds, 120 lbs. and up.

Heifers.—Fores, 100 lbs. and up.

Hinds, 100 lbs. and up.

The first grade stall-fed should be paid for at, say, 3s. to 4s. per 100 lbs. dressed weight more than the second grade. This would give the necessary inducement to stall feeders to finish off their animals. At present a number of stall-feds just scrape through and are being paid for at the same rate as those that are properly finished off.

If first grade stall-feds were paid for at the present time at, say, 26s. and the second grades at 22s. instead of at the present flat rate of 24s., it would give the necessary encouragement for the cattle to be properly finished off, and I feel sure that this would soon be reflected in better prices in England. The most important point in this business is to standardise your grades and never vary them. Grass-feds should only be included when they come up to the same standards. This will mean that practically all the grass-feds will only be killed for chilling during three or four months of the year, say March to June.

Forequarters.—Prices realised in England for forequarters during the English summer months this year have not covered the cost of preparation and sending to market. It would have paid better to have boiled these down for tallow.

bone and meat-meal, if it had been possible to know how prices would be. This is very difficult, as so much depends on the weather in England when the beef arrives and also on the quantity of beef entering the country at about the same time from other sources. It does seem, however, that fore-quarters thin in the ribs and lacking in cover should not be exported. They might be used for boneless beef, or, if converted into a salted product, a trade might be worked up in the native reserves. In Brazil a salted product, known as "XARQUE," is consumed all over the country, especially where the population is sparse and the people can only occasionally get fresh meat. This product keeps for two or three months and can be retailed from country stores. I would suggest that a few bales be imported from Brazil as a trial and, if the natives appear to like it, an experimental lot could be produced at the works. The dry and sunny climate of Southern Rhodesia should be suitable for seven or eight months of the year for preparing this product. This recommendation is based on the idea that natives would eat a great deal more meat than they do at present if they had the means of getting it at all times.

Breed.—The question of the breed of the cattle is not of such immediate importance as that of finish, but efforts should not be relaxed to bring in more bulls. At Bulawayo Show we saw pedigree bulls being sold at very low prices. As soon as overseas prices for beef start to improve cattlemen will be looking for bulls and prices will rise.

There are very varied opinions as to the lines that should be followed. We found quite a number of cattle raisers of the opinion that the English breeds were not hardy enough and, after three generations, the cattle lacked constitution and vigour. There seems to be a decided tendency towards the introduction of Africander blood to bring in robustness and resistance to withstand the long, dry season. The Africander has not been looked upon as a beef animal heretofore, but I understand that several men in the Union are working on the lines of evolving a beef type.

In one part of South America, where conditions are not unlike those of Southern Rhodesia, Zebu bulls are imported

from India and a cross with native cows gives an animal the hindquarters of which are quite satisfactory for export as chilled beef.

The Africander appears to have a number of traits in common with the Zebu. There is a precedent to go on in the evolution of a beef type in Texas by using Zebu blood to give robustness under the trying natural condition there, and it is, to my mind, quite feasible that a similar type could be evolved by using Africander blood. On our visit to one large Africander ranch herd we were much struck by the fine appearance of the Africander cattle there, and especially that of the calves, and we were there at about the worst time of the year.

The question of breed appears to me to be one that can only be solved by the cattlemen themselves, as in some districts the European breeds will probably do very well where supplementary feeding can be given but, in other districts, under ranching conditions, the introduction of a hardy strain seems to be desirable.

I do not think it is possible to produce in Southern Rhodesia the same beef conformation as in the Argentine, except perhaps in a few favoured localities, as the exceedingly favourable natural conditions they possess are not found in Southern Rhodesia, but I see no reason why the standard reached by the other cattle exporting countries of the Southern Hemisphere should not be attained by Southern Rhodesia.

Age.—Most of the bullocks killed for chilled beef are of five or six years and some are older. If a raiser has to keep his bullocks until they are six years old, I am afraid that the prospects of continuing as a serious competitor in the chilled beef business would be rather small. However, I have seen some three or four-year-old cattle which were very satisfactory and which show that the necessary weight can be put on quickly. All people consulted agree that from weaners to two-year-olds, the cattle suffer unduly during the dry season and they receive such a check that they will not give the necessary chilled beef weight and condition until they are five or six years old.

I hope it will not be considered presumptuous on my part, after my short visit to the country, but I cannot help but lay the greatest emphasis on this phase of the business.

There may be other reasons, such as sickness and disease, which influence the question, but I consider that as far as possible, calving should take place around November and December, so that the fast-growing calf at four months will be getting a plentiful supply of milk. The best parts of the ranch should be paddocked off and reserved for weaners, with water at hand. We have had it expressed to us that the southern ranchers should send their weaners to the central zone, where they could have the veldt feed supplemented by legume hay and thus keep them growing unchecked. I have been given to understand everywhere that land and labour in Southern Rhodesia are cheap and, therefore, this supplementary feeding can be carried out on an economical basis. The whole business eventually depends on the question of cost of production but, to succeed with chilled beef, the eventual aim of all cattle raisers must be to turn off bullocks at not over four years old and giving 600 lbs. to 750 lbs. dressed weight. The extra cost of supplementary feeding should be compensated for by turning off the bullocks eighteen months earlier than is at present taking place and, at the same time, the beef would be more in line with English requirements and command an improved price in consequence.

Works.—The existing works of the Rhodesia Export and Cold Storage Company, Ltd., at Bulawayo is quite capable of dealing with all the chiller type of animal that will be produced during the next three or four years. It would be uneconomical at this stage to build a second works for chilling; in fact, under the existing arrangements it is to the advantage of all parties concerned that the present works should work at maximum capacity, thus reducing costs and also the amount to be found by the Government.

From a geographical point of view, the most economical arrangement for additional works would appear to be that the movement of stock from breeding to fattening would be from South to North (Salisbury zone) with a works along the railway to Beira and eventual outlet at Beira, but it is doubtful if the rapid sea transport so essential for chilled

beef could be undertaken from Beira, until the country is in a position to guarantee regular quantities and tonnage sufficient to interest a shipping company to guarantee a short sea voyage. To help this point, the prospect of the export of dairy produce and citrus fruits should not be overlooked.

In the event of the Salisbury district becoming a bigger fattening centre for the chilled beef business and the amount of chiller type animals warranting its erection, a works at that point should be considered from the point of view of killing the cattle off at the point where they are in the best condition, but the Odzi-Umtali region has a claim from the point of view of killing native scrub cattle, and also that it is much nearer the Port of Beira. We were informed that there were 600,000 cattle within 100 miles radius of Umtali.

It must be borne in mind that a meat works should be worked to capacity, because there are always a number of overhead charges which are the same in any event. It is also more economical to have a few big units rather than numerous small ones. Also, frozen beef, whether in quarters or boned, and canned meats are, to a great and growing extent, subsidiary products where chilled beef is concerned. Consequently, any outlet for scrub cattle in this region should be considered in conjunction with the eventual outlet of chilled beef, and any works put up to relieve the scrub cattle situation should be planned with an idea to future extension to take in chilled beef production as well.

From the appearance of most of the native reserves we passed through, it is obvious that over-stocking is prevalent, but it is questionable whether any works erected to kill off the surplus would be sure of getting the necessary supplies to assure its economical functioning. The natives, I understand, look upon cattle as a form of wealth and, in general, are not ready sellers. In Madagascar, where there are over 8,000,000 cattle owned by natives, the meat works of the island find a great difficulty to obtain 100,000 head per annum for export, because the native only sells enough cattle to pay his taxes and cattle raising is not carried out from the commercial standpoint. A similar state of affairs appears

to exist in Southern Rhodesia, but the situation requires urgent handling, as over-stocking will seriously reduce the stock carrying capacity of the country.

A large proportion of the native cattle would not be fit for frozen beef, either in quarters or boneless. The canned goods market is flooded with goods produced at extremely low cost. Boiling down is a very uneconomical process, as there is little value in the animal outside of the hide and tallow, which to-day's values would scarcely be worth 15s. per head at the works before expenses were added.

I consider that the existing works in Southern Rhodesia have, with small additions, sufficient capacity to deal with the surplus of scrub cattle at present existing. There is not, in my opinion, sufficient attraction at the present time for any company to erect an additional works in Southern Rhodesia for the treatment of cattle, scrub or otherwise, because international markets are not favourable and there is not a sufficient number of cattle available but that eventually, when the necessity is felt, a works should be erected in a position suitable for exporting its products *via* Beira and that, for the purpose of shipment of frozen beef, dairy products and citrus fruits, a small cold store alongside the docks at Beira would be a desirable adjunct as, in addition to its use for storage before shipment, there is a possibility of developing a business in ships' stores.

Condition of Cattle on Arrival at Works.—The cattle I saw being killed at the works in Bulawayo were reasonably free from bruises.

The padding of cattle trucks and the dehorning of cattle are points that have already been dealt with in the country. Dehorning appears to be essential where stall-feeding is practised and, in all cases, it is highly desirable. The cattle trucks are loaded from the side, which presents a good deal of difficulty, especially where the loading race is too short to hold the number of animals to be loaded into the truck.

Stall-feeding.—It appears to me that the chilled beef business in Rhodesia will eventually resolve itself into the raising of cattle in the ranching areas and their sale either as weaners to growers, who can feed them satisfactorily during the dry

season, or as stores to stall-feeders, who will finish the cattle off for export. The question of the price for stores is one that should resolve itself automatically if the grading of the beef at the works is kept to a fixed standard on lines similar to those indicated in this report. It appears to be indicated that the feeders should be taken to the white maize growing areas where the manure resulting from stall-feeding will be of most value and where the foodstuffs are most economically produced.

Stall-feeding in pens holding about ten bullocks appears to be the most current method and is to be recommended on the grounds of effective control of progress made. Stores for stall-feeding should be in fair grass-fed condition when put on to concentrates. Thin cattle are likely to prove too expensive. The general opinion is that bullocks can be fattened with an average of three bags of meal (200 lbs. per bag) plus the necessary protein food, mineral salts, hay and roughage. Fair type ranch bullocks should be put on an average of $2\frac{1}{2}$ lbs. live-weight per day and should not require more than two or three months in the pens.

Summary of the Annual Report

OF THE DIVISION OF FORESTRY FOR THE YEAR 1934.

By E. J. KELLY-EDWARDS, M.A., Dip. For. (Oxon.),
Chief Forest Officer.

The fifteenth annual report of this Division, here submitted, is able to record both steady progress and consolidation of previous years' operations.

The year under review is perhaps the most notable in the annals of the Division, in that, after fifteen years of struggle and argument, the method of disposing of forestry's primary product—timber—has been placed on a sound footing. The system hitherto in force of assessing royalty on the sawn product of timber instead of on the timber in the round has been the cause of enormous losses of valuable wood and revenue, not to mention grave anxiety as to the probable fate of the plantations of exotic trees now in course of establishment at the expense of the State.

The history of forest departments in other Colonies and Dominions shows that the early years of development are always accompanied by many difficulties, not least of which is the natural reluctance of a people to expend funds on forest projects which take many years to show a return. This Division has not escaped this experience, so that it is the more pleasing to record that intermediate revenue yields on a small scale are now forthcoming from the Colony's first afforestation venture—the Mtao Forest Reserve—which has been in existence since 1922.

Increased mining activity and the dwindling of accessible native timber supplies have drawn attention to the value of plantation timber—mainly Eucalpts—for mining purposes. There is sufficient material of this class to supply a greater demand than exists at the present time, but high railage costs

are an important adverse factor, especially as the mining districts in general occur in localities unsuited to the growing of exotic timber on a commercial scale.

The shortage of fuel for tobacco curing is causing some anxiety in certain districts. In many localities the shortage has been accelerated by wasteful utilisation of indigenous timber resources, and by failure to augment the slow growing native supplies by actual afforestation. In Mashonaland at least it may be stated that fast growing eucalypts suitable for fuel may usually be grown where tobacco will grow. To obtain adequate yields, however, it is necessary for the tobacco grower to realise that afforestation must be given a definite place in farming operations and that it is false economy to confine fuel plantations to the poorest soils and their care and attention to the slack season.

A notable event of the year, particularly gratifying to the Forest Service, but nevertheless of wider national significance, was the change effected in the administration and objects of the European unemployment relief operations in forestry. Prior to the institution of the new order the relief camps had proved an attraction to many who had no right to demand assistance from the State, while the control of the camps placed undue responsibilities on forestry officials whose time could have been more profitably spent on their legitimate duties.

The change in policy now in operation has resulted in the abandoning of the E.L.A.O. Section of Mtao as a relief camp. It is now used solely to accommodate elderly and infirm men who are engaged only in nursery work. Stapleford camp maintains its original status to provide for unemployables or as a refuge for temporarily unemployed. It is, however, rendered less attractive by the fact that a "deferred pay" system now operates which affords an inmate a sufficient wage to maintain himself, but, at the same time, compels the saving of a certain sum over a period. When the stipulated sum has been accumulated the man is required to leave the camp for some months, and if he returns he is engaged at a reduced rate of pay, part of which is still deferred.

The internal control of the camps is now in the hands of Welfare Officers, and forestry officials are thus absolved from many minor and petty routine duties which have no connection with their normal functions.

An indication of the efficacy of the new arrangements, even if brighter trade conditions are taken into account, is the fact that whereas during 1933 the number of men at the relief camps was 173, at the end of 1934 only 69 were employed.

The main features of the year's operations at the various stations were as follows:—

1. **Stapleford Forest Reserve.**— Surveys which have been in arrear for some years have been brought up to date, with the result that all the planted areas and areas prepared for immediate extension—totalling some 4,000 acres—have now been mapped to a scale of 1/7200. All topographical features and contours at 25 feet intervals are shown.

Measurements of a 13-year-old 1 acre stand of mixed *Pinus patula* and *Pinus radiata* with 640 trees to the acre gave a volume down to 3 inches diameter of 4,800 cubic feet under bark. Mean tree 7.6 inches d.b.h. Mean height 62 feet. Bark 10.4%.

Locusts caused a considerable defoliation in wattles, oaks and certain pines, but all trees subsequently regained their normal foliage.

Rodents continued to cause heavy losses in Portuguese cypress stands, but only in certain localities, which in future will be avoided for this species.

One fire occurred in plantations and destroyed 28 acres of five-year-old *Pinus radiata*.

1,736 acres were blanked and all plantations are now fully stocked.

208 acres of new plantings were completed, bringing the total area of plantations to 3,146 acres.

European labourers constructed 1,300 yards of external roads and kept roads in repair. Two miles of reserve roads and 4.8 miles of bridle paths were constructed.

20,000 trout fry were liberated in the Odzani and Mawodza Rivers. Spawning of older trout was noted as late as September.

2. **Mtao Forest Reserve.**—The extra soil preparation now given to new plantings and blankings has given very beneficial results, and as a consequence blankings are almost up to date.

A total of 207 acres of new plantings and replantings was accomplished, and the grand total area of plantations on all sections of the Reserve is now 1,769 acres.

Forty-four acres of *Eucalyptus spp.* were thinned giving a volume removed of 3,186 cubic feet, of which 1,911 cubic feet were sold at a nett profit of 8.4d. per cubic foot. This is extremely satisfactory in view of the fact that the produce was from thinnings only.

The European relief operations were abandoned in June and this section is now maintained by native labour. The nursery remains under the name of "The Chaka Nurseries," in which some 48 elderly and infirm men are employed. During the year 766,000 plants were maintained or raised at the nursery.

3. **Salisbury Forest Nursery.**—Large quantities of trees and shrubs were raised for sale to the public and issue to Government Departments. Revenue improved by £112 over the previous year and totalled £1,852, of which £573 was made up of free issues.

Experiments with formalin, potassium permanganate and ammonium sulphate, carried out to cope with "damping-off" fungus gave successful results with the formalin treatment.

Nine hundred and thirty-three persons visited the nursery during the year.

4. **Kalahari Sand Forests.**—An important valuation survey of certain “Rhodesian Teak” forests was carried out by the staff in this area. Valuable volume table figures have been obtained and ecological data collected.

The main operation in this area is the protection of the forests from fire. In spite of a bad fire season excellent results were obtained, and out of a total of 405,450 acres protected only 1.2% was traversed by fire. This is the lowest percentage recorded since the inception of fire protection operations ten years ago.

Messrs. Rhodesia Native Timber Concessions continued exploitation in the “Teak” forests in the Nyamandhlovu and Wankie Districts. The Zambesi Saw Mills Limited concession in the north Wankie District expired at the end of the year. Royalties from these concessionaires are paid to the Lands Department.

5. **Wankie Game Reserve.**—The Game Warden and native rangers made extensive patrols during the year. The process of mapping the reserve continued satisfactorily.

With a view to making the area accessible to visitors 60 miles of roads were constructed, and there are now 89 miles of road available for car traffic in the dry season. Three rest huts were erected for the convenience of travellers.

The water supplies were again considerably below normal and the game have shown a general decrease in numbers. Extensive improvements to water supplies contemplated for the current year will go far towards remedying the present unsatisfactory position.

6. **Victoria Falls Reserve.**—The camping area at the Falls was improved by the furnishing of bathing facilities, and 1,200 tourists patronised the area during the year. New vistas along the river bank and in the “Rain Forest” were made available.

The outstanding feature of the year was the unveiling of the Livingstone Memorial near the Devil's Cataract. The Memorial and surroundings are maintained by the Curator.

7. General Summary.

Station.	Area planted 1934. Acres.	Total area of plantations. Acres.	Expenditure, exclusive of enrolments.			Revenue.		
Stapleford . . .	207	3,146	£1,795	11	1	£33	1	6
Mtao	207	1,769	744	8	6	147	7	4
Salisbury								
Nursery	—	44	790	18	7	1,852	14	7
Kalahari Sand	(405,450 acres							
Areas	protected)		860	3	2	1,859	17	6
Wankie Game								
Reserve . . .	Patrolled		430	7	5	—		
Victoria Falls								
Reserve . . .	Maintained		120	17	10	—		
Totals	414	4,959	£4,742	6	7	£3,893	0	11

8. **Private Forests.**—During the year 27 private estates were visited and advice given by Forest Officers. Addresses were given to two meetings of Farmers' Associations.

In May-June the writer inspected certain "Rhodesian Teak" forests in north-eastern Bechuanaland on behalf of the Bechuanaland Protectorate Administration. A report was submitted suggesting the lines on which exploitation of these forests might be carried out.

9. **Forestry in Native Reserves.**—The Forest Officer employed by the Native Reserves Trust made preliminary reconnaissances in nine reserves and interim inspections in two reserves during the year, bringing the total of reserves inspected since his appointment in 1933 to thirty-one.

He draws attention to the urgent need for conservation and less wasteful utilisation of existing resources. In some reserves, even if the population remains stable, there is insufficient growing stock to meet the future timber requirements of the inhabitants, so that actual afforestation is essential to augment the supplies.

10. **Research and Investigation.**—Valuable ecological data were collected by all technical officers. The Forestry Herbarium is expanding and the Division expresses its gratitude to the Imperial Forestry Institute and to Kew for effecting 436 determinations of botanical specimens submitted for identification.

During the year a valuable report was received from the Imperial Institute on the suitability for paper making of *Pinus radiata*, *P. patula* and *Cupressus lusitanica* grown at Inyanga. Examination revealed their suitability both physically and chemically for the manufacture of pulp for strong wrapping paper or newsprint.

11. **Publications.**—During the year the writer contributed four articles to the local and London Press. The following, apart from editorial notes, appeared in the *Rhodesia Agricultural Journal*:—

July.—"Some Trees, Shrubs, Herbaceous Plants, Climbers and Water Plants suitable for the Colony," by J. W. Barnes, Manager, Forest Nursery.

August.—"Some Facts about Tung Oil," by R. H. Finlay, B.A., Dip. For. (Oxon.).

12. **Administration.**—During the year the staff of the Division comprised the Chief Forest Officer, 4 District Forest Officers, 1 Manager, 7 Foresters, 4 Foremen, 1 Game Warden, 1 Curator and 1 Clerk.

The writer records with pleasure the co-operation of all members of the staff.

FLUE-CURED TOBACCO.

FACTORS DETERMINING TYPE AND SEASONAL DIFFERENCES.

By F. R. DARRIS, L. F. DIXON and P. M. GROSS,
Duke University, Durham, N.C.

From *Industrial and Engineering Chemistry*, Vol. 27, No. 10,
October, 1935.

The tobacco industry has a rich background of empirical knowledge and information which awaits correlation with more exact scientific criteria such as the chemical composition, physical properties, and physiological behaviour of tobacco as a plant. The establishment of such criteria is essential to the development of a worthwhile programme looking to the improvement of the plant through cultural practices, selection, and fertilisation. This paper presents in condensed form the results of a detailed survey, extending over five years, of flue-cured tobaccos from representative tobacco markets in the entire flue-cured tobacco region from southern Virginia to Georgia. In quantity and in money value flue-cured tobacco is our most important tobacco crop.

As material for this survey samples of a medium grade of tobacco used in cigarette manufacture were chosen. Their prior history is briefly as follows: After being harvested green by the farmer, the leaves are subjected to the thermal process known as flue-curing (3, 5) by the farmer and are then sold on the market by him. The purchaser subjects them to further heat treatment and drying. This latter operation is known as redrying. Both the flue-curing and redrying operations are reasonably well standardised in practice. After being subjected to these processes, the tobacco is in the condition in which it is stored for ageing. Samples taken at this stage were utilised for the survey. Although the composition of

the tobacco in this state differs considerably from that of the uncured green leaf, it represents the stabilised form or condition of the tobacco which most closely approaches that in which it is empirically judged as an agricultural commodity.

The composition at this stage can be related to the growing conditions, the soil, and the seasonal and climatic factors which influence each tobacco type.

(The methods of sampling and methods of analysis are then given in full, but these are omitted for the purpose of this reprint.—Ed.)

Discussion of Results.—The United States Department of Agriculture, in its statistical work, divides flue-cured tobaccos into four types. Tobaccos from the Old Belt Flue-Cured and Middle Belt Flue-Cured regions, comprising a portion of the central and north central counties of North Carolina and the south central counties of Virginia, make up U. S. Type 11. Eastern North Carolina Belt tobaccos from the northern two-thirds of the Coastal Plain of North Carolina are U. S. Type 12. The South Carolina and Border Markets tobaccos, from the lower third of the North Carolina Coastal Plain and adjacent and equal territory in South Carolina, make up U. S. Type 13. U. S. Type 14, consisting of Georgia and Florida Flue-Cured, is produced in southern Georgia and in a small adjacent area in northern Florida.

For purposes of blending, flue-cured cigarette tobaccos are usually divided into six types on the basis of the area in which they are produced. These areas are shown on the map and differ from the federal classification in that U. S. Type 11 is subdivided into three sections or types—the Durham, Winston, and Danville. Eastern North Carolina is U. S. Type 12, South Carolina is U. S. Type 13, and Georgia is U. S. Type 14.

These divisions are of real significance in that they represent differing temperatures, rainfall, soil types, and growing seasons. The mean temperatures and rainfall are indicated on the map. The soil types in the Coastal Plain are mainly Marlboro, Norfolk, Craven, Ruston, Bradley, Dunbar, and Tifton sandy loams. The principal soil types in the Piedmont area are Durham, Granville, Appling, Cecil, Helena, and

Surry sandy loams. The planting season in Georgia extends from March 20 to April 20; in South Carolina from April 1 to April 25; in eastern North Carolina from April 15 to May 5; in Durham from May 1 to May 20; and in the Winston and Danville areas from May 20 to June 10. The harvesting period in Georgia is from June 1 to July 20; in South Carolina from July 1 to August 15; in eastern North Carolina from July 15 to August 25; in Durham from July 25 to September 15; in the Winston region from August 20 to September 25; and in the Danville area from August 25 to October 1.

The greatest differentiation in character and composition of the tobacco may be obtained by dividing the entire flue-cured tobacco section into the two major geographical divisions of Coastal Plain and Piedmont. The Coastal Plain tobaccos comprise the Georgia (U. S. Type 14), South Carolina (U. S. Type 13), and Eastern North Carolina (U. S. Type 12). The Piedmont tobaccos are composed of the Durham (U. S. Type 11), Winston (U. S. Type 11), and Danville (U. S. Type 11).

The Coastal Plain tobaccos are, generally speaking, light-bodied⁽¹⁾ thin tobaccos of very yellow colour, whereas the Piedmont tobaccos are thicker, gummier, heavier bodied, of darker colour, more aromatic, and of fuller⁽²⁾ smoking quality.

Table I. shows that the Piedmont tobaccos are higher in total and soluble nitrogen than the Coastal Plain tobacco, although the insoluble (protein) nitrogen is not appreciably higher. The total nonvolatile acids, nicotine, and petroleum ether extract are higher in the Piedmont tobaccos. The Piedmont tobaccos are considerably higher (25 per cent.) in

(1) "Body" is a technical trade term of great significance to judges of tobacco, which cannot readily be given exact scientific definition. It is essentially an empirical judgment of "substance content" and is not related to thickness, weight per unit area, or density, as such. Its opposites are characterised as "washed out" or "chaffy."

(2) "Fullness" is a term descriptive of smoking reaction. It denotes the extent to which a certain tobacco will satiate the desire to smoke. It is not necessarily connected with "strength," a term which attempts to describe the degree to which the smoke of certain tobacco is irritating.

nicotine content than those produced on the Coastal Plain. The petroleum ether extract, which appears to be affected more by rainfall than by geographical location, is considerably higher (12 per cent.) in the Piedmont tobaccos. Shortage of rainfall increases the amount of this extract, and excess rainfall reduces it regardless of the section concerned. Although differences in hydrogen-ion concentration exist between the various types, when a division is made into the two major types mentioned no difference is found. The sugar content is greater in the Coastal Plain tobaccos. This is especially true of the Georgia and to some extent of the South Carolina type. The lowest carbohydrate content is found in the Winston and Danville types which are produced in the north-western portion of the flue-cured area.

As the commercial utilisation of the various tobacco types is based on their geographical origin, it is worth while to relate their trade characteristics and chemical composition to the conditions under which they are produced.

Georgia Type.—This is a thin, yellow, hygroscopic tobacco of a good smoking quality. It is characterised by its silky texture, its hygroscopicity, and its decided tendency to redden or darken during ageing. This latter characteristic is detrimental from the viewpoint of the export trade. The tobacco is produced largely on Tifton and Norfolk sandy loam soils in a sub-tropical climate and mean annual temperature of 67° F. and a mean annual rainfall of 43 to 50 inches.

The growing conditions and characteristics of this type of flue-cured tobacco are related to the chemical composition as shown by the type averages (Table I.). The thinness, yellow colour, and hygroscopicity are reflected in the relatively low nitrogen and very high carbohydrate content. In this, as in other cases to be noted later, reddening or darkening during ageing accompanies a high percentage of total nitrogen that is soluble and seems to indicate a definite correlation between them. The nicotine content is below a medium value but greater than would be expected in tobaccos of 23 per cent. carbohydrate content.

South Carolina Type.—This is a thin, yellow tobacco, of rather silky texture, of slightly more body than the Georgia,

TABLE I.—AVERAGE ANALYSIS OF SIX TYPES OF FLUE-CURED CIGARETTE TOBACCO FOR THE 1928-32 CROPS.

Type.	Crop.	Portion of Total N Soluble.	Total N.	Water- Sol.	Amino N.	Nico- tine.	Reduc- ing Sugar.	Total Sugar.	Total Acidity.	pH.	Petroleum Ether Extract.	Rainfall.
		%	%	%	%	%	%	%	Cc.		%	
Coast and Plain.												
Georgia	1928	64.5	1.72	1.11	0.142	2.27	20.73	21.61	12.36	5.17	5.17	Above normal.
	1929	65.0	1.65	1.04	0.169	2.53	22.74	23.59	12.99	5.30	4.98	Excessive.
	1930	64.2	1.51	0.97	0.170	2.28	24.35	25.12	12.49	5.51	4.85	Below normal.
	1931	70.4	1.69	1.19	0.227	2.91	20.91	21.45	13.11	5.27	6.83	Deficient.
Av. for 4 crops		65.9	1.64	1.08	0.177	2.45	22.18	22.94	12.74	5.31	5.46	
South Carolina												
	1923	65.3	1.70	1.11	0.179	2.03	19.25	20.38	11.64	5.21	5.63	Above normal.
	1929	62.5	1.76	1.10	0.191	2.04	21.40	22.16	11.87	5.32	4.97	Excessive.
	1930	65.2	1.78	1.16	0.195	2.48	20.31	21.22	12.04	5.11	5.73	Below normal.
	1931	67.7	1.67	1.13	0.227	2.52	19.13	19.56	13.19	5.26	6.71	Below normal.
	1932	59.5	1.90	1.13	0.219	2.73	18.62	19.26	11.19	5.11	...	Below normal.
Av. for 5 crops		64.2	1.76	1.13	0.202	2.36	19.74	20.52	11.99	5.20	5.76	
Eastern N. Carolina												
	1928	63.3	1.80	1.14	0.201	2.09	18.10	18.85	12.95	5.15	5.82	Above normal.
	1929	58.6	1.91	1.12	0.226	2.20	17.75	18.38	12.94	5.27	5.18	Excessive.
	1930	63.7	2.12	1.35	0.226	3.01	17.51	18.27	12.86	5.18	6.68	Deficient.
	1931	61.2	1.70	1.04	0.190	2.18	20.54	21.08	12.28	5.14	6.00	Above normal.
	1932	63.4	2.03	1.36	0.189	3.35	17.63	18.30	14.43	5.01	...	Deficient.
Av. for 5 crops		62.5	1.92	1.20	0.206	2.57	18.31	18.98	13.09	5.15	5.92	
Av. for Coastal Plain area		64.2	1.73	1.14	0.196	2.46	19.93	20.66	12.60	5.22	5.70	

Type.	Crop.	Portion of Total N Soluble.	Total N.	Water- Sol. N.	Amino N.	Nico- tine.	Reduce- ing Sugar.	Total Sugar.	Total Acidity.	pH.	Petroleum Ether Extract.	Rainfall.
		%	%	%	%	%	%	%	Cc.		%	
Piedmont.												
Durham ...	1928	65.9	2.03	1.37	0.223	3.07	14.67	15.52	11.97	5.20	6.92	Late rains.
	1929	60.4	1.87	1.13	0.194	2.46	19.06	19.84	13.13	5.29	5.50	Excessive.
	1930	68.8	1.99	1.37	0.225	3.41	17.74	18.39	14.02	5.24	7.28	Deficient.
	1931	61.8	1.78	1.10	0.186	2.51	19.75	20.47	12.94	5.20	6.63	Above normal.
	1932	67.5	2.00	1.35	0.197	3.41	16.85	17.60	14.63	5.09	...	Deficient.
Av. for 5 crops		64.9	1.94	1.26	0.205	2.97	17.61	18.36	13.34	5.20	6.58	
Winston												
	1923	63.6	2.25	1.43	0.263	2.50	14.12	14.96	13.50	5.28	6.38	Late rains.
	1929	66.8	2.08	1.39	0.242	2.54	17.03	17.70	14.29	5.30	5.32	Excessive.
	1930	67.3	2.17	1.46	0.239	3.79	16.39	17.02	15.61	5.29	6.85	Deficient.
	1931	65.4	1.88	1.23	0.244	2.38	17.95	18.54	14.45	5.33	6.46	Above normal.
	1932	69.0	2.00	1.38	0.233	2.59	16.18	16.86	16.87	5.21	...	Deficient.
Av. for 5 crops		66.3	2.08	1.38	0.244	2.52	16.33	17.02	14.86	5.28	6.25	
Danville												
	1928	66.7	2.01	1.34	0.198	3.41	13.87	14.70	14.01	5.36	6.61	Late rains.
	1929	64.8	1.76	1.14	0.188	3.13	17.26	17.94	13.94	5.36	5.54	Excessive.
	1930	67.6	2.07	1.40	0.208	3.90	15.98	16.61	15.00	5.13	7.48	Deficient.
	1931	63.0	1.81	1.14	0.212	2.84	16.24	18.89	14.19	5.31	6.40	Above normal.
	1932	68.4	1.93	1.32	0.183	3.54	17.04	17.77	15.38	5.11	...	Deficient.
Av. for 5 crops		66.1	1.92	1.27	0.198	3.36	16.08	17.16	14.50	5.25	6.51	
Av. for Piedmont area		65.7	1.98	1.30	0.215	3.03	16.68	17.51	14.29	5.25	6.46	

and with some tendency to darken during the ageing process. This tobacco is generally produced on Norfolk, Marlboro, Portsmouth, Ruston, and Dunbar sandy loam soils, in a warm temperature and sub-tropical climate with a mean annual temperature of 62° to 65° F., and a mean rainfall of 45 to 50 inches. Two small areas with different rainfall are noted on the map. In the vicinity of Chadbourn, N.C., is a small, low-rainfall area (40 to 50 inches), whereas in the vicinity of Mullins, S. C., there is a high-rainfall region (50 to 60 inches). The tobacco from these small areas correlates with the rainfall conditions both as to character and composition.

Table I. shows that the South Carolina type has an increased total nitrogen and decreased total sugar as compared with Georgia, but its composition is definitely that of a light-bodied, yellow tobacco. As previously indicated, in view of the percentage of total nitrogen that is soluble, we would not expect this type to darken as much during ageing as the Georgia type, but rather more than the eastern North Carolina type. Empirical observations on colour changes during the ageing of these types confirm this theory. In this connection it should be stated that good response to ageing and proper aroma development are associated with darkening of colour. In other words, the Georgia type will develop aroma and age more satisfactorily from the standpoint of domestic consumption than the South Carolina or eastern North Carolina types. On the other hand, from the viewpoint of colour preservation, which is of importance in export tobaccos, the eastern North Carolina is best, the South Carolina second best, and the Georgia least desirable. The nicotine content of the South Carolina type is the lowest for any of the flue-cured tobaccos. Here, as in other instances, low nicotine content and low petroleum ether extract appear to be correlated with production in a high-rainfall area.

Eastern North Carolina Type.—This is a thin, bright yellow tobacco which retains its colour excellently. This type reacts to ageing slowly and is not very aromatic. It is of equal or slightly heavier body than the South Carolina and Georgia types, and is not so hygroscopic. This tobacco is produced largely on Marlboro, Norfolk, and Craven sandy loams in a region of mean annual temperature of 60° to 63° F.

and mean annual rainfall of 45 to 53 inches. A small portion of the area has a rainfall of 50 to 60 inches as indicated on the map. Tobaccos from this particular area are of very poor quality, are washed out or soggy in character, and do not represent the type area.

The analysis of this tobacco (Table I.) shows an increasing nitrogen, nicotine, total acid, and petroleum ether extract content, and a lowered total sugar content as compared with the Georgia and South Carolina types. It is the most acid of all the flue-cured types as shown by pH measurements of water extracts. The analysis is typical of thin, light-bodied, yellow tobaccos, and is distinctive by reason of the low percentage of total nitrogen that is soluble. This is in line with the slow response to ageing and the colour retention of this type. This characteristic is responsible for the demand for this type by the export trade.

Durham Type.—This is produced in the east Piedmont region of North Carolina, adjacent to the eastern North Carolina area. Generally it is thicker, more gummy, heavier bodied, slightly more orange in colour, and of fuller smoking quality than the Coastal Plain tobaccos. It is more responsive to ageing and becomes darker in colour than the eastern North Carolina or South Carolina types. It is produced largely on Durham, Granville, Appling, Cecil, White Store, Alamance, and Helena loams. This wide variety of soils coupled with a low (42 to 45 inch) and median (45 to 50 inch) rainfall, and the fact that there is a fairly large thermal gradient through the area, tends to make Durham the most irregular of all the flue-cured types.

The analysis of this type of tobacco (Table I.) shows it to be a transitional type as indicated by its slightly increased nitrogen content and decreased sugar content; nevertheless, it is distinctly western or Piedmont in character as shown by the greatly increased nicotine and petroleum ether extract content. Also the percentage of total nitrogen that is soluble is in line with the behaviour during ageing and the colour retention of this type.

Danville Type.—This is the thickest, heaviest bodied, and darkest coloured, and has the fullest smoking quality of

all the flue-cured cigarette type. It ages well, becoming quite aromatic, and develops a dull dark orange colour at the same time. This type is produced in the north central Piedmont region on heavier, darker soils of considerable clay content. The greater percentage of this area is in a low rainfall region (42 to 45 inches).

The Danville tobaccos selected for the analyses (Table I.) were on the lighter bodied side of the type and for this reason are not quite representatives of the type. Notwithstanding this fact, the total nitrogen-carbohydrate ratio, the very high nicotine content, and the petroleum ether extract indicate clearly that this type is a heavily-bodied western (Piedmont) tobacco, grown on rather heavy soil and under decreased rainfall. Here again the nicotine content and petroleum ether extract appear to be related to the diminished rainfall. The factors of heavy soil, decreased rainfall, and temperature are all operating to produce a thick, heavy-bodied tobacco of high nicotine and gum content and of low carbohydrate content.

Winston Type.—This is a relatively thin, heavier bodied tobacco of orange colour, which ages well with the production of excellent aroma and smoking quality. It is produced in the north-western Piedmont section largely on Durham, Granville, Appling, and Surry loams, with a mean annual rainfall of 44 to 48 inches and mean annual temperature of 56° to 58° F.

The analysis (Table I.) reveals, by its raised total nitrogen, nicotine, and gum content, and its reduced sugar content, that it is a typical Piedmont, heavier bodied type. The influence of slightly increased rainfall is also reflected in its reduced nicotine content and petroleum ether extract as compared with the low-rainfall Danville type. It is clearly intermediate between the Durham and Danville types in composition and can be considered the most characteristic Piedmont type. As in the Danville type the high percentage of total nitrogen that is soluble is correlated with its ability to age well with the tendency to darken in colour and to develop aroma.

Rainfall.—It has been shown that the character and chemical composition of tobacco varies with the normal rain-

fall prevalent in the different areas where each type is grown. It has also been noted that smaller areas, within the type area, where the rainfall varies considerably from that of the area as a whole, produce tobacco of decidedly different character and quality. Furthermore, differences in seasonal rainfall common to all types will affect all types, and will produce wet, dry, normal, or second-growth crops. These effects, although not sufficient to eliminate all type characteristics, have a marked influence on the chemical composition, physical properties, and smoking quality of the tobacco. Each of the seasonal influences described is represented in the crops included in this work.

The general rainfall conditions under which the crop grew have been tabulated with the chemical analyses (Table I.) to facilitate the study of this influence of chemical composition. The analyses given are representative of tobaccos grown in the indicated area under the existent rainfall. No attempt has been made to show the distribution of rainfall over the growing season. This factor is of importance and explains to some extent the differences found between two crops with the same general rainfall.

The Georgia area, because of its early growing season, is likely to vary appreciably from the general rainfall conditions which prevail in the remainder of the flue-cured regions. Thus in 1928 Georgia and the entire Coastal Plain experienced a rainfall above normal throughout the season, whereas the Piedmont section had excessive rains during the maturing and harvesting season after a relatively dry July. In 1930 the rainfall was below normal in Georgia and South Carolina, and deficient in the remainder of the area. In 1931 rainfall was deficient in Georgia, below normal in South Carolina, and above normal in the remainder of the flue-cured area. In 1932 the rainfall was normal in Georgia, below normal in South Carolina, and deficient in the remaining areas. Very excessive rainfall was experienced in all regions in 1929.

Seasonal rainfall is reflected in the chemical composition and character of the tobacco in the same manner as has already been described. Excessive rainfall produces thin, light-coloured, light-bodied tobaccos, of increased carbohydrate content and a lowered percentage of nicotine, petroleum

ether extract, and total nitrogen, as well as a reduction in the percentage of total nitrogen which is soluble. Deficient rainfall produces thick, hard, gummy, dark-coloured tobacco of decreased sugar content, greatly increased nicotine and petroleum ether extract content, increased total nitrogen, and an increased percentage of total nitrogen that is soluble. Below-normal rainfall is not quite sufficient for normal plant development. Above-normal rainfall is slightly more than is required for best tobacco quality. If either of these conditions is experienced, the changes in composition and quality will be in the directions previously indicated, but these departures from normal are not sufficient to damage the quality of the crop materially.

Excessive rains coming late in the season, after a dry period, may cause the maturing crop to renew growth. Such tobacco is very poor in texture, colour, and smoking quality. Such tobacco may have a composition analogous to that produced under very deficient rainfall. The differentiation is most manifest in a greatly increased amino nitrogen content in these second-growth tobaccos.

Acknowledgment.—The authors acknowledge with gratitude the help of J. A. Hall and E. P. Jones, who carried out some of the determinations and assisted in the preliminary work of this programme.

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Domestic Water Supplies and Sanitation on the Farm.

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(Continued.)

SANITATION.

On most farms the problem of sanitation is one to which far too little attention has been given, with the result that the health factor of safety is lowered to a dangerous point. The disposal of sewage in an efficient manner is important from the view of hygiene.

Sewage-borne diseases are numerous, and privies (closets), urinals, cess pools, sewage pits, manure heaps, etc., are all potential dangers. Disease may be carried by man, animals and flies. Certain members of any community may be disease carriers, although exhibiting no signs or symptoms of disease themselves, and an outbreak, the source of which would be extremely difficult to discover, may occur through such carriers. Flies will settle on any unpleasant substance and may carry disease germs away and deposit them on food. The outbreak of disease is facile and must be guarded against. The health of man is all-important to successful undertakings, and every precaution should be adopted to prevent its undermining.

The following principles should be adopted and adhered to strictly:—

1. Never allow sewage or excrements to come in contact with the food or water of human beings or live stock.
2. Never expose excrements to flies or similar germ-carriers.

3. Do not make use of sewage for fertilising vegetable gardens.
4. Never discharge or throw sewage into streams or old wells or any place from which the remotest chance of drainage into streams or other sources of water supply might exist.

It will be obvious that if these vital points are considered in the planning of a sewage system the safest method of sewage disposal will result. It is an unfortunate thing, however, that the cost of installation of a really efficient sewage disposal system is somewhat high, and consequently many farmers may not be able to afford it. But there is no reason why systems better than those in general use should not be utilised. With this idea in view, various sanitary utilities will be described. In general they may be discussed under two heads: (a) privies for excrements only, and (b) works for handling all wastes where water is available for flushing.

Pit Privy.—This is the cheapest form to instal and is suitable where plenty of land is available for new sites. It cannot, however, be considered as safe, as the collections of excreta may eventually become too great for the purifying powers of the soil, and contamination of water supplies may result through the leaching of unpurified wastes. Figure XV. shows a privy of this type. It is essential that the situation of the pit privy shall not be in wet ground or rocky formation, nor where the surface of the ground or underlying strata slope towards any source of domestic water supply. The whole structure must be made fly and mosquito-proof and the openings for ventilation and light should be covered with gauze. This privy will be essentially portable, as it will have to be moved as soon as the pit becomes full. The pit must be kept dry, and to ensure this, earth must be banked all round the bottom of the privy itself to a height of 12 inches. The pit should be shallow, not more than three feet deep, and when two-thirds full must be covered in and the privy moved to another place. A pit privy should not be closer to any source of water supply than 100 yards and must always be below it. Loose dry earth should be added to the accumulations in the

pit every day, and when abandoned, earth must be heaped up into a mound over the pit to prevent rain water standing there.

The seat should be made movable to permit of cleansing, and should have a separate hinged cover over the opening. Under the seat and towards the back, boards covered with galvanised iron should be set sloping inwards to prevent excreta being deposited elsewhere than in the pit. A ventilator must be provided below the seat.

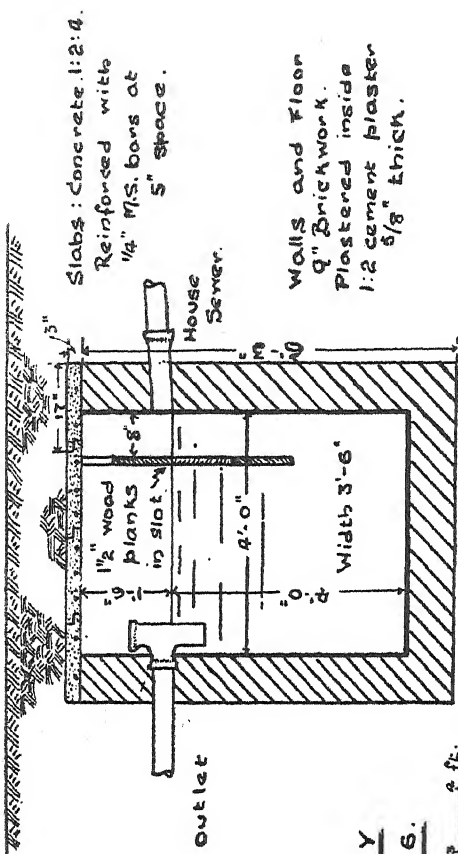
The roof should project outwards for a distance of 9 inches to prevent water dripping directly on to the earth bank round the bottom of the privy.

Sanitary Privies.—This type of privy is such that the excrements are not in contact with the earth, and it is also proof against the entry of flies, rats and other vermin. The container may be movable (pail or bucket) or may be fixed as in the case of an underground metal, masonry, concrete or brick tank. The former is the usual type on the farm, and a suitable form of construction is shown in Figure XVI. The closet itself is constructed of brick, with mosquito-proofed ventilating and lighting openings. The floor should be preferably of concrete laid on a bed of well-compacted broken stone or hard brick set inside the walls of the closet. The concrete should receive a finishing coat of cement mortar floated on. The floor is best set above natural ground level and should have a slope towards the door in order that it may be efficiently cleansed. The pail space is bricked in and its floor should slope down from the front towards the back and from the sides towards the centre. A detail of this is shown. The seat, which should be hinged and have a separate hinged cover over the opening, is set over the bricked pail space sufficiently low down as just to clear the top of the pail. The pail space stands away from the sides of the closet to permit of thorough cleaning of the closet. The opening through which the bucket is removed should be closed by means of a sliding metal door fitting closely against the back of the closet. A close fit may be obtained by plastering with cement mortar.

Frequent removals of the bucket are very necessary, and it is advisable to wash out the buckets after use with some disinfectant. The buckets or pails should be made of good galvanised iron, seamless and perfectly water-tight. The use of dry loose earth is strongly recommended. Each stool should be covered with about $1\frac{1}{2}$ lbs. of dry earth immediately after each deposition. The best earth to use is a dry and moderately light loam. Sand and gravel are quite unsuitable. The use of earth is to enable bacterial action to take place, the nitrogenous matter being converted into ammonia compounds and thence to nitrates and nitrites. The night soil obtained from earth closets must be disposed of, and this may be done by burying in some locality where the danger of pollution of water supplies is not present. Night soil may be buried in a thin layer by a plough or in a shallow hand-dug trench. Should intestinal disease be known to be present, however, the contents of buckets must be destroyed by burning or rendered sterile by the use of a strong chemical disinfectant. Night soil should never be used as a surface fertiliser for vegetables or any crop where contact between the plant and excrement may lead to disease.

As regards the vault or underground water-tight container type, this will not be described in detail, but a few general hints are given. The whole should be mosquito-proofed and it must be well ventilated. If concrete is used for the vault, a mixture of 1:3:6 may be adopted and the whole interior surface plastered with a thick layer of 1:2 cement mortar. The seating arrangement will be similar to that described for the pit privy. The use of earth must be adopted, and this may be shovelled in at intervals through the opening from which the vault contents will be removed. This opening must have a flap or other suitable cover. Contents may be removed at fairly long intervals, depending on the size of the vault. Figure XVII. shows a vault closet.

Chemical Closets.—As the name implies, these closets make use of chemicals to deodorise and disinfect. Whether complete disinfection takes place is a doubtful fact, and consequently the contents of the pails should be well buried. Frequent emptying is necessary. As a rule, chemical closets are manufactured in two forms: the pail and the tank. The



VAULT PRIVY
Concrete 1:3:6.



SINGLE-COMPT. SEPTIC TANK

FOR 4 PERSONS

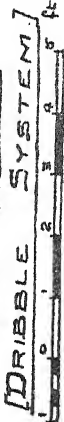


Fig. XVII.

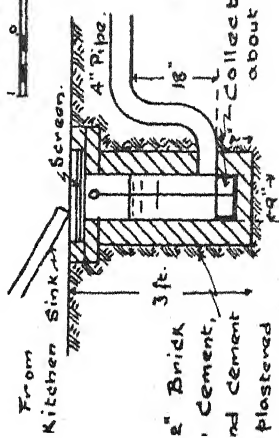
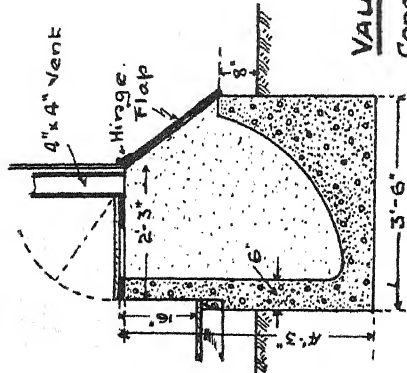


Fig. XVIII.

former is very similar to the ordinary sanitary closet, a chemical being placed in the pail first. The excrements must be kept submerged. Ventilation or draught is essential, and this is usually effected by connecting up the closet vent pipe with a chimney or carrying it up above the top of the roof. Chemical closets are simple and compact, easily moved and of good appearance. Chemicals used are of two types as a rule: a coal tar product used to disinfect and deodorise, and a caustic solution which breaks up all the solids and which should kill all bacterial life.

The chemical tank closet is similar in operation, but the container is fixed underground. If a large tank is installed it does not require such frequent emptyings as the pail.

Septic Tanks.—These are receptacles in which sewage remains for a certain time, during which rotting or digestion takes place. The lighter solids float on top of the tank in the form of scum, and the heavier sink to the bottom, forming sludge. The sludge is retained in the bottom of the tank and is gradually converted into liquids and gases. This process is known as septicisation. It must be understood that the liquid or effluent from the tank is far from safe; in fact, it is highly dangerous, and may possibly contain more bacteria than raw sewage does. In consequence, it can never be discharged in any vicinity where pollution of water may occur. The purposes of a septic tank are to cause a partial settlement of the solids and by bacterial action ensure the destruction of organic matter. The decomposition resulting from this action is carried on in the presence of oxygen, and, after complete exhaustion of the oxygen, the action gradually ceases. The effluent from a septic tank may be more conveniently distributed than is raw sewage. Distribution originally was effected by broad flooding or furrow irrigation, but this is a method which can never be recommended to the farmer. A better method is to distribute it below the ground by means of agricultural tiles or drains laid with open joints. The effluent may also be treated by passing it through slow sand filters. This, under farm conditions, is not very suitable, as filters are usually neglected and clogging of pipes occurs. Further, unless filters are covered, great danger exists from flies. The process of filtration, to be effective, must be carried

out in the presence of air, and this means intermittent doses. The whole process, although capable of excellent results, cannot be considered other than very expensive on a farm. The sub-irrigation method of disposal will be found to be the cheapest.

Parts of System.—The system consists of four parts: (a) The house sewer from house to tank; (b) the septic tank; (c) sewer from tank to distribution area, and (d) the distribution area and system.

(a) *House Sewer.*—The length of the house sewer should not be less than 100 feet, and a greater length is better. The grade on which it is laid should be as steep as possible and continuous. Changes in grade should be avoided, as in a small system continuous flow is not possible, and cleansing of the sewer can only be effected by flushes. The grade on which the sewer should be laid depends on the diameter of the pipe. The fall in 100 feet should not be less than 2 feet for 4-inch diameter, $1\frac{1}{2}$ feet for 5-inch and 1 foot for 6-inch. The sewer may be made of vitrified salt-glazed concrete or cast iron pipe. For a small household of, say, five persons, the 4-inch diameter may be utilised. The jointing must be effective to prevent leakage of sewage previous to septicisation and to prevent the entry of roots of vegetation. When jointing, care must be taken to prevent the interior of the pipes from being clogged in any way with the jointing material, and swabbing must be resorted to. Obstructions occur very easily, due to rags, paper, garbage and grease. Grease traps should be placed at the outlets of baths and sinks. Figure XVII. shows a grease trap constructed out of brick and piping. The brick is set in cement mortar (1 to 3) and plastered inside with a 1 to 2 cement plaster. At the bottom of the trap a small tin with handle attached is placed to collect silt, etc. Grease will float on top of the water in the trap and must be removed periodically. This is effected by lifting up the tin which normally rests at the bottom.

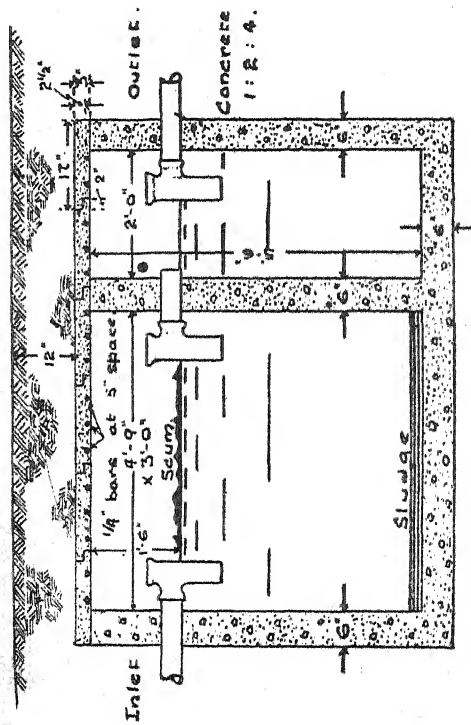
It must be noted that rain water must not be led into the sewer, but must be carried away by separate drains.

(b) *Tank.*—No hard and fast rules can be laid down for dimensions of tanks, as the quantity of sewage per head

varies very considerably, but as a general guide it may be assumed that it amounts to about 35 gallons per head per diem. Sewage should remain in the tank for 48 hours at least, and consequently a minimum capacity of 70 gallons per person should be allowed for. To keep on the safe side we will assume a capacity of 80 gallons per head. Septic tanks may be either single or double compartment and may discharge the contents after the tank is once filled by a dribble system; or alternatively, the tank once becoming filled, discharge of the whole of the contents in one flush may take place. The latter system is the better and is effected by means of an automatic and simply operating siphon, but the cost is a little more. The two-compartment tank is to be recommended, as the sludge is retained in the first compartment and remains undisturbed during the discharge of the effluent. Sludge need only be removed at long intervals—probably every two years. It is always advisable to instal a septic tank of a slightly larger size than estimated immediate requirements may necessitate, as the longer the period of septicisation, the less is the chance of offensive gases becoming noticeable. Figures XVIII. and XIX. show respectively a single-compartment tank suitable for four persons and a double-compartment tank suitable for six persons. A tank sufficiently large to deal with the sewage from a household of eight persons will require to be built to the same dimensions generally as that in Figure XIX., but the width will have to be increased to 4 feet. Reinforcement remains the same. For any requirements above eight persons, the size may be obtained by allowing 13 cubic feet water capacity per head. If the width of the tank is increased beyond 4 feet, then additional steel reinforcement will be required in the covering slab. It is advisable to cover the whole tank with a foot of earth.

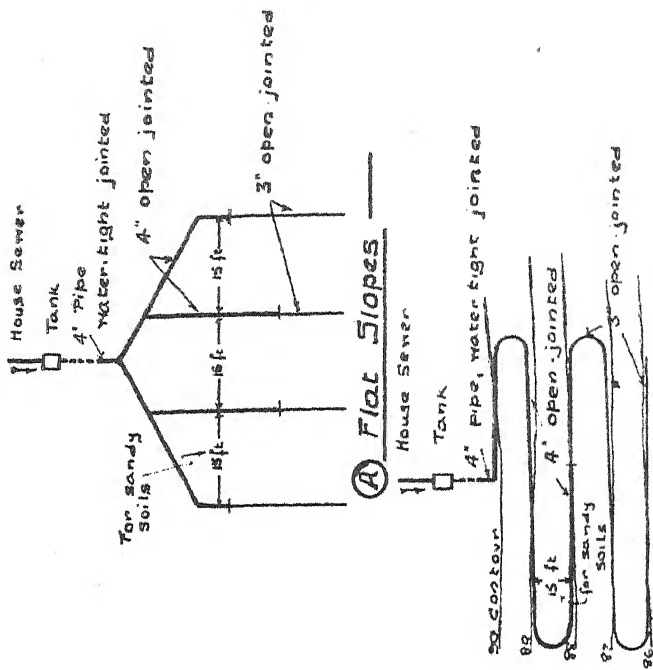
The ventilation necessary to carry off gases from the tank is effected by the inlet tees at the tank and through the house sewer and house vent. The reason for fitting submerged inlets and outlets is to prevent the scum which forms on the top of the liquid from being disturbed.

Disinfectants must never be allowed to enter a septic tank, or they will kill the bacteria which break down the organic matter and septicisation will cease.



— TWO-COMPT. SEPTIC TANK —
 SIZE FOR 6 PERSONS
 [DRIBBLE SYSTEM]

Fig. XIX.



— SEWAGE DISTRIBUTION —
 Fig. XX.

(c) *Sewer from Tank*.—This may conveniently be a 4-inch pipe, which should be laid as carefully as the house sewer. Grade should be as uniform as possible, and the whole must be well jointed and water-proof. The length will naturally vary according to the distance from the tank to the distribution area.

(d) *Distribution*.—The method of disposal of the effluent from a septic tank is the most important factor to be considered in planning the system. An efficient method of disposal means a safe and efficient system; inefficient disposal may lead to the outbreak of disease, or at least offensive odours. The method usually adopted is to distribute all the effluent about 18 inches below the surface by means of a system of open jointed pipe lines. The area of land required per head depends entirely upon the type of soil in which the distribution system is laid. The most suitable type is a dry, porous, well-drained, sandy soil, but in many localities such a soil is not available. About 200 square feet of land will be required per head in such soil and about 400 square feet in a heavy loam. In sandy soils the distribution pipes should be laid about 15 feet apart, and in heavy soils about 8 to 10 feet apart. Figure XX. shows two methods of laying out a distribution system. It is advisable to utilise as flat a piece of land as possible for disposal of the effluent, and the grade of the pipes in the absorption area should be about 1 in 400 or 3 inches in 100 feet. If the land is flat, system "A" may be utilised. On steep land it is necessary to adopt the lay-out "B" of Figure XX. This lay-out consists of a long length of piping laid on a grade of about 1 in 400, then a steep fall to the next level about 15 feet distant in sandy soils or 10 feet in heavy loam, and then back again on the flat grade. All bends in the distribution system should be made easy. Sharp bends must be avoided. The jointing is important. At the beginning of the distribution the pipes should be laid with ends as close together as possible. This should continue for about one-third of the length. For the next third the joints should be about one-eighth of an inch apart, and for the last portion one-quarter of an inch jointing should be used.

The first half of the distribution may be of 4-inch agricultural drain tiles, and the second half of 3-inch. The

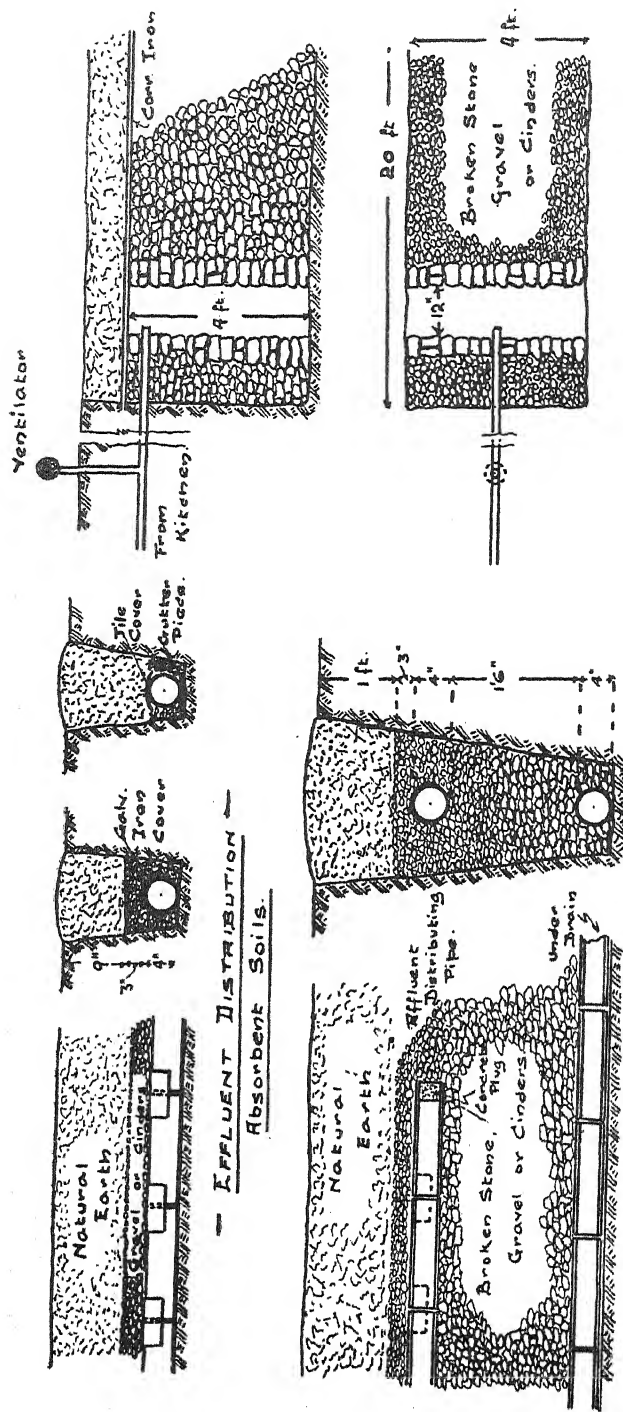


Fig. XXI.

1 2 3 4 5 ft.

For 4 Persons, Kitchen Waste only.

Fig. XXII.

1 2 3 4 5 ft.

whole of the distribution should be laid on as even a grade as possible; if the same grade is not possible throughout, the lengths on each particular grade should be made long. The upper portion of the piping at the joints must be covered over to prevent the entry of sand or silt into the pipes. This may conveniently be done by means of pieces of plain galvanised iron bent to a semi-circle. This is shown in Figure XXI. Another method is also shown in the same figure. This latter consists of tile gutter pieces and tile covers. The effluent in this case discharges from the sides of the pipes. It is advisable to cover the distributing pipes with clean gravel or stone broken to a small size.

In very heavy clay soils it will be found necessary to instal a system of under-drains. This is shown in Figure XXI. The water draining from these under-drains must be discharged into open drains eventually, but must not be allowed to endanger any water supply. Between the effluent distributing pipe and these under-drains about 18 inches of cinders or gravel is placed.

The absorption area is best covered with a grass crop. Trees should be avoided or the roots may enter the piping, causing a breakdown of efficient working.

The ends of all distribution pipes must be closed with concrete plugs. This point must be adhered to strictly. The water level in the absorption area must never be less than 12 inches below the distributing pipes.

The absorption area must never be located above wells or any other source of supply, and should be distant on the lower side of such sources at least 200 feet.

French Drain.—The French drain forms a very useful method of disposing of ordinary kitchen slops and bath water, but it should not be used for the disposal of human excrements, either solid or liquid. It is easily and cheaply made, and, provided it is placed in a porous sandy soil, as a rule requires very little supervision. It is essential, however, that all liquids passed into a French drain should be free from grease and solid matter. To this end it is absolutely necessary to instal grease traps at the outlets of all sinks, baths or similar appurtenances. A ventilator should be placed in the

house pipe before it enters the drain. This ventilator will carry off any gases which may accumulate in the drain. French drains should be installed some distance way from dwellings.

An excavation in the ground is filled with broken stone or well-burnt clinker to within a foot of the surface. It is then covered over with corrugated iron, on top of which about 12 inches of soil is placed. An opening should be left where the house pipe enters to prevent the end of the pipe from becoming choked up. The opening may be formed by placing perforated corrugated iron sheets in a vertical position and keeping them apart by means of larger stones. In place of this method a small open well may be built of large stones without mortar, into which the house pipe discharges. Figure XXII. shows a French drain of this type. The drain must be located in a well-drained soil where the water level will never rise sufficiently high to be above the level of the bed or floor of the drain. For the disposal of kitchen slops alone a drain 4 feet by 4 feet and 20 feet long should suffice in a well-drained soil. For a household of four persons a drain to dispose of bath and kitchen water should be of the same cross section, but three times as long—that is, 60 feet in length. French drains require occasional cleaning out, the periods they will operate efficiently depending entirely upon the soil conditions.

Natives.—In conclusion, it may be wise to draw the attention of the farmer to the sanitary conditions of natives employed on the farm. It is usually an exception to find that any provision for the disposal of excrements has been made in native locations on farms. Such a condition is deplorable. No employer can be certain that every native working for him is entirely free from disease. The disease carrier is a hidden menace, and consequently every step should be taken to improve conditions in order that the danger of a sudden outbreak of disease shall be as remote as possible. An unroofed pit privy is easily constructed, and every location should be supplied with these, and natives prevented from depositing excrements in open lands or bush.

Forestry in Southern Rhodesia.

Statement prepared by E. J. KELLY-EDWARDS, Chief Forest Officer, Southern Rhodesia, for the Fourth Empire Forestry Conference held in the Union of South Africa, September-October, 1935.

Continued

PART II.

ANNUAL INCREMENT AND UTILISATION OF HOME-GROWN TIMBER.

A.—INCREMENT.

Exotic Trees.—Measurement of numerous stands throughout the Colony indicate that the average annual increment for conifers—*Pinus spp.*, *Cupresses spp.* and *Callitris spp.*—is about 150 cubic feet per acre, while for broadleaved trees, mainly *Eucalyptus spp.*, a fair average is 200 cubic feet per acre per annum. In the high rainfall zones of the Eastern border double these increments is the rule rather than the exception.

Indigenous Trees.—Data on the rates of growth of indigenous trees are still extremely scanty, but, on a conservative basis, it is considered that the following figures will, at least, indicate the probable increment, after making allowance for waste, decay and fire. Von Mantel's formula has been adopted.

Type of Forest.	Estimated rotation years.	Estimated volume per acre.	Increment per acre $V = \frac{1}{2}r$	Increment per sq. mile.	Merchantable area of type.	Total increment of type.
		cu. ft.	cu. ft.	cu. ft.	sq. miles.	cu. ft.
Mountain Forest	150	4,000	53	33,920	10	339,200
Muhatja	120	60	1	640	363	232,320
Mangwe	80	60	1.5	960	3,015	2,894,400
Thorn-veld	80	120	3	1,920	1,878	3,605,760
Mahobohobo ...	80	90	2.25	1,440	26	37,440
Msasa	80	180	4.5	2,880	7,479	21,539,520
Umgusu	100	390	7.6	4,864	2,698	13,133,072
Mfuti	100	180	3.6	2,304	2,220	5,114,880
Mopani	120	120	2	1,280	4,500	5,760,000
Total... ..	...	...	...	2,373	22,189	52,656,592

In the following table State and other indigenous forest have been combined, and the loss by fire, waste and decay has not been estimated in figures.

Table III.—Annual Increment of Merchantable Forest.

Ownership.	Conifers.			Broadleaved.			Total Net Increment
	Area.	Net Increment per sq. mile.	Total.	Area.	Net Increment per sq. mile.	Total.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	sq. miles	cu. ft.	million cu. ft.	sq. miles	cu. ft.	million cu. ft.	million cu. ft.
State & other indigenous ... ..	...	...	...	22,189	2,373	52.66	52.66
State exotic .	2	96,000	0.19	2	128,000	0.26	.45
Other exotic .	2	96,000	0.19	9	128,000	1.15	1.34
Total	4	96,000	0.38	22,200	2,435	54.07	54.45

B.—UTILISATION.

1. **Timber.**—Lack of statistical data makes the task of computing the annual utilisation of timber extremely difficult, but by employing certain assumptions, which it is hoped are sufficiently conservative, an attempt is made to arrive at an estimate on the following lines:—

There is no doubt that fuel is the main form of utilisation. Assuming that 400,000 natives live in the areas of merchantable forest and that each native consumes 100 cubic feet of fuel a year, the annual utilisation is 40,000,000 cubic feet. It is similarly assumed that about 45,000 of the European population, resident in accessible areas, use, for household purposes, 6,750,000 cubic feet of timber per annum.

For the five years ended 1933 the average annual production of flue-cured tobacco was about 10,000,000 lbs., and on an average it requires two cords, or 120 cubic feet, of solid timber to cure 800 lbs. of tobacco. Fuel for this purpose, therefore, takes up 1,500,000 cubic feet per annum.

Many of the larger mines obtain their power from coal or oil, but for those which use wood or charcoal fuel, it is hazarded that the annual consumption is 10,000,000 cubic feet.

For mining purposes, rough buildings, kraals and general farm purposes, it is estimated that Europeans and natives in accessible areas use some 9,550,000 cubic feet of timber per annum.

The production of sawn timber is more simple to estimate, and it is probable that the converted material for railway sleepers, mining and building purposes, furniture, etc., is approximately 650,000 cubic feet per annum.

2. **Minor Forest Products.**—The utilisation of minor forest products in a well wooded country of over a million native inhabitants, must obviously reach vast proportions. Fruits, thatch, fibres, bark, roots, gum, etc., are taken and treated as gifts of Providence, and it is not possible at this stage of the Colony's comparative youth to estimate the annual consumption of these many minor products.

Table IV.—Annual Utilisation of Home-grown Timber.

Ownership.	Conifers.		Broadleaved.			
			Converted. (All types of product).		Equivalent in standing timber.	
			Quantity. Value.		Quantity. Value.	
			Quantity. Value.		Quantity. Value.	
	(1)	(2) million cu. ft.	(3) £	(4) million cu. ft.	(5) £	(6) million cu. ft.
State and other.	Negligible	68.45	222,000	79.30	100,000	79.30
						100,000

*Table IV. A.—Annual Utilisation of Home-grown Produce.
(By Types of Product.)*

Type of Product.	Conifers.	Broadleaved.	
		Quantity. (Equivalent in standing timber)	Value.
(1) TIMBER.			
		Million cu. ft.	
Fuel... ..		58.25	£48,500
Rough building, Mining and Farm Purposes	Negligible	19.10	45,900
Sawn Timber ...		1.95	5,600
Total	—	79.30	£100,000
(2) MINOR FOREST PRODUCE.			
Thatch, Fibres, Bark, Roots, Fruits, Gum, etc.	No data available.		

PART 12.

PRIMARY FOREST INDUSTRIES.

Apart from numerous bodies interested in wood contracting for fuel and mining timber, the numbers of whom it is not possible to ascertain, there are probably not more than six concerns primarily engaged in lumbering and sawmilling.

Large scale operations are carried out only in the *Baikia plurijuga* forests in the north-western portion of the Colony. The sawmilling industry produces timber for railway sleepers, mining purposes, building and wagon materials, boxes and furniture.

Table V.—Primary Forest Industries.

Industry.	Quantity of timber consumed.	Value of product at place of preparation.	No. of persons employed.
	cu. ft.	£	
Lumbering and Sawmilling ...	1,950,000	84,400	75 Europeans 2,000 Natives

PART 13.

STATISTICS AS TO EXPORTS AND IMPORTS OF TIMBER AND MINOR FOREST PRODUCE.

A.—EXPORTS.

1. **Timber.**—The principal timber exported from the Colony is “Rhodesian Teak” (*Baikia plurijuga*) mainly in the form of railway sleepers to the Union of South Africa. Parquet flooring from the same species is exported overseas. Small quantities of *Pterocarpus angolensis*, *Copaifera coleosperma*, *Azelia cuanzensis*, etc., for furniture and wagon wood purposes are exported to neighbouring territories.

2. **Minor Forest Produce.**—The quantity of minor forest produce exported is negligible, even when account is taken of re-export of imported produce to the value of about £200 per annum.

B.—IMPORTS.

1. **Timber.**—Statistical methods in force in the Colony render it difficult to furnish in detail the requirements of this Statement. Imports are classified under three broad heads, viz., “Unmanufactured Wood,” “Partly Manufactured” and “Joinery (wooden framework for houses, etc.).” These three classes represent, in value, approximately £45,000, £15,000 and £49,000 respectively per annum.

Of "Unmanufactured Wood" imported annually the specified items are as follows:—

- (1) Ash, bass, mahogany and walnut.—235 cubic feet, value £99. Foreign origin, except mahogany from British Honduras.
- (2) Jarrah and Karri.—945 cubic feet, value £246. Australian origin.
- (3) Oak.—347 cubic feet, value £148. Japan and United States origin.
- (4) Teak.—11,176 cubic feet, value £5,700. Mainly from British India and balance from Siam, Indo-Chino and Dutch East Indies.
- (5) Pitch Pine.—16,778 cubic feet, value £2,217. Mainly from United States.
- (6) Other Pine.—359,586 cubic feet, value £29,331. Origin, in order of importance, Sweden, Finland, the United States and Canada.

Of "Partly Manufactured Timber," flooring and ceiling comprise 128,871 cubic feet, value £13,159, and other planed and grooved 18,435 cubic feet, value £3,626 per annum. Sleepers of the value of £19,612 are imported from Northern Rhodesia and Portuguese East Africa. The origin of the two former items is probably foreign.

If floorings, ceilings, planed and grooved timber and joinery are assumed to be of softwoods, it will be seen that conifers occupy by far the greater proportion of imports, and, on the same assumption, it is estimated that at least 75% of the total imports is of foreign origin.

In the case of certain items of exports and imports, where values only are given, an attempt has been made to arrive at quantities on a value basis, in order that the following tables may serve their purpose of indicating consumption and supply.

In Table VI., "Imports," an arbitrary figure of 40% has been taken to represent the loss in converting standing timber.

Table VI.—Average Annual Exports and Imports.
(Period 1930 to 1933 inclusive).

EXPORTS.			IMPORTS.			BALANCE, plus or minus			
Quantity.			Quantity.			Quantity.			
Value.	Converted.	Equivalent in standing timber.	Value.	Converted.	Equivalent in standing timber.	Value. (Col. 1—Col. 4)	Converted. (Col. 2—col. 5).	Equivalent in standing timber. (Col. 3—Col. 6).	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
£	million cu. ft.	million cu. ft.	£	million cu. ft.	million cu. ft.	£	million cu. ft.	million cu. ft.	
Conifers ... ..	...	...	81,428	0.65	1.08	—81,428	—0.65	—1.08
Broadleaved ...	59,512	0.56	1.68	27,730	0.17	0.28	+31,782	+0.39	+1.40
Total... ..	59,512	0.56	1.68	109,158	0.82	1.36	—49,646	—0.26	+0.32

2. **Minor Forest Produce.**—The imports of minor forest produce, classified as such, are small, and the following table shows the average annual imports for the four-year period 1930 to 1933. Of these imports 6.7% of the total quantity and 35% of the total value are from Empire countries—principally the United Kingdom.

Table VI.A.—Average Annual Exports and Imports.
(Minor Forest Produce.)

Type of Produce.	Exports.		Imports.	
	Value.	Quantity.	Value.	Quantity.
	£	lbs.	£	lbs.
Resin, Shellac & Gum Preparation.	Small quantities, mainly imports re-exported		1,775	159,000

PART 14.

SUMMARY AND OUTLOOK.

A.—THE TOTAL HOME CONSUMPTION OF HOME-GROWN AND IMPORTED TIMBER COMPARED WITH THE TOTAL INCREMENT.

The difficulties encountered in the compilation of the various tables, which are now summarised in Table VII., have been explained in previous parts of this Statement. The figures given lay no claim to accuracy, for they are arrived at from estimates based mainly on a personal knowledge of the Colony and only partly on a somewhat shallow foundation of statistical data. The figures nevertheless indicate truly that increment is not keeping pace with consumption.

Table VII.—Summary Statement.

(Expressed as Standing Timber.)

	Utilisation (Table IV., cols. 1 & 4). (1) million cu. ft.	Exports (Table VI., Col. 3). (2) million cu. ft.	Consumption of home- grown timber (Col. 1 minus col. 2). (3) million cu. ft.	Imports (Table VI., col. 6) (4) million cu. ft.	Total consumption of home-grown and imported timber (Col. 3 plus col. 4). (5) million cu. ft.	Net increment (Table III., cols. 3. & 6). (6) million cu. ft.	Balance plus (+) or minus (—). (Col. 6 minus col. 5). (7) million cu. ft.
Conifers ... ..	...	...	...	1.08	1.08	0.38	— 0.70
Broadleaved	79.30	1.68	77.62	0.28	77.90	54.07	—23.83
Total	79.30	1.68	77.62	1.36	78.98	54.45	— 24.53

B.—PROBABLE DURATION OF VIRGIN MERCHANTABLE SUPPLIES AT NORMAL RATES OF CUTTING, PROSPECTS OF MEETING REQUIREMENTS FROM REGROWTH FOREST AND BY AFFORESTATION.

The difficulty of estimating the duration of virgin merchantable supplies is at once apparent when it is remembered that Southern Rhodesia is a Colony still in the early stages of development. This development is of a steady and comparatively rapid character, for, since the occupation of the territory in 1890, the European population has increased from

a mere handful to about 50,000, while the native population has, at least, doubled itself to reach the present figure of over 1,000,000.

Agricultural development, which is synonymous with destruction of virgin forest, has proceeded steadily, especially during the past 30 years, and there are now over 3,000 square miles of forest converted to agricultural land. If the period, since occupation, is taken, it means that over 70 square miles of forest are being surrendered each year. As shifting cultivation, which implies the "working out" of the soil, is still prevalent, and as sub-tropical conditions tend to make the recovery of abandoned areas an extremely lengthy process, this surrender of forest must, for the present, be considered permanent.

Of the 22,000 square miles of merchantable forest it is estimated that, in addition to the areas surrendered to cultivation, about 700 square miles are cut over each year to supply timber and fuel.

At this rate, which is not stable, as development is increasing, virgin merchantable supplies cannot last 30 years.

Increment must, however, be taken into account, but, even so, it has been shown that there is a debit balance which is estimated to be, at present, over 24,000,000 cubic feet of timber per annum.

While consumption per square mile of merchantable forest approximates 3,500 cubic feet per annum, natural increment per square mile amounts to only two-thirds of the consumption. The indigenous forest cannot keep pace with utilisation, because it is of savannah type and of slow growth, and because it is subject to serious depredations by fire and wasteful methods of exploitation.

It follows that more economic utilisation of indigenous produce augmented by afforestation with fast growing species of exotic trees must be practised, if supply is to balance consumption.

To achieve the partial remedy of economic utilisation means converting the improvident character of the native population, and generations must elapse before this object can be attained. The civilised element in the Colony is not with-

out blame in this respect, but sheer necessity is already forcing more economic usage on the European.

The Colony is fortunate in possessing many localities where the remedy of afforestation can be applied. There are few areas where fast growing hardwoods for general rough purposes cannot be grown. The same statement cannot apply to softwoods, but ample land exists in the more favoured eastern section of the Colony to supply the whole of the Colony's ultimate softwood requirements. The solution is simply an extension of the present annual programme of planting, which has been restricted hitherto partly by lack of financial provision and partly by lack of appreciation of the necessity for afforestation.

C.—SHORT SUMMARY OF STEPS WHICH SHOULD BE TAKEN TO PROTECT AND DEVELOP THE FOREST RESOURCES OF THE COUNTRY.

Without doubt the greatest need facing the Colony is the more economic use of its indigenous forest resources. The well wooded nature of the country has been its greatest asset in developing the agricultural and mineral possibilities, but at the same time it has been a drawback in that the wasteful practices of the native inhabitants have been assimilated by the European occupiers.

In some respects the unsoundness brought about by excessive fire injury and the handicap of shortness of bole occasioned by the open habit of growth, together with the fact that certain woods are either non-durable or difficult to work are legitimate reasons for the prejudice against native timbers.

The timbers have, nevertheless, many qualities which seasoning and preservative treatment can enhance. With the development of such treatment and the exercise of more forbearance on the part of the user, there is no reason why native timbers should not enjoy a wider use than that of mere fuel.

Stricter measures for the suppression and control of the frequent forest fires which sweep the country are urgently needed, although it is fair to add that public opinion is now awakening to the fact that the fire evil is robbing the country of its soil as well as its trees. Efforts, already started, to

bring about a change in the improvident habits of the large native population should be redoubled. In this lies the Colony's greatest forest problem.

The Colony is entirely dependent on imports for its softwood requirements. The need to replace these imports by home-grown softwoods is obvious. Fortunately, certain areas, in suitable localities, have been set aside as a first step to meeting this need, but up to the present the annual programme of afforestation has been inadequate, so that an acceleration of planting is an immediate necessity.

Existing legislation, with the exception of that dealing with forestry in Native Reserves, is primitive and inadequate, and the time has now arrived for a comprehensive Forest Act to provide for the protection and control of State and certain other forest and for regulating the disposal of State forest produce.

APPENDICES.

A

Various unpublished Departmental and other reports.

B

- 1920. Government Notice No. 596. Regulations and tariffs for cutting mining timber.
- 1924. Land Bank Act. Money may be advanced for tree planting.
- 1928. Herbage Preservation Ordinance, 1913, Amending Act.
- 1928. Land Tax Act and Amendment Acts 1929, 1931.
- 1929. Native Reserves Forest Produce Act.
- 1930. Land Apportionment Act.
- 1932. Nurseries Ordinance 1909, Amendment Act.
- Government Notice No. 415. Provides for fumigation of plants.
- Government Notice No. 462. Regulates imports and exports under Nurseries Ordinance.
- 1933. Land Bank Amendment Act.
- Government Notice No. 218. Provides for giving notice of timber cutting under Mines and Minerals Ordinance.
- Government Notice No. 505. Regulating sale and taking of forest produce in the Native (Purchase) Area.

C

Various Departmental Bulletins reprinted from the *Rhodesia Agricultural Journal*, and dealing mainly with tree planting on farms.

D

- 1927. "*Oxytenanthera abyssinica* (A. Richard) Munro: Occurrence, gregarious flowering and natural regeneration in Southern Rhodesia." By J. S. Henkel, Dip.For., R.I.E.C. S.A. Journal of Science, Vol. XXIV., 1927.
- 1928. "The relation of vegetation to water supply in Southern Rhodesia." By J. S. Henkel. S.A. Journal of Science, Vol. XXV., 1928.
- 1931. "Types of vegetation in Southern Rhodesia." (With Maps.) By J. S. Henkel, Dip.For. (Cooper's Hill), F.R.S. (S.A.). Proceedings of the Rhodesia Scientific Association. Vol. XXX., 1931.
- 1933. "Some Trees, Shrubs and Lianes of Southern Rhodesia." By Miss E. C. Steedman, M.A. Printed by the Rhodesia Printing and Publishing Co., Ltd., Salisbury.

Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants. Creepers and Seeds.

OBTAINABLE AT THE GOVERNMENT FOREST
NURSERY, SALISBURY.

1. Transplants of forest trees, etc., as far as in stock, are obtainable at the subjoined rates.

2. Orders should be addressed to the Chief, Division of Forestry, Salisbury; or Manager, Forest Nursery, Salisbury.

3. All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for.

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any station or siding in Southern Rhodesia.

6. Purchasers of trees contained in tins either of 25 or 4 trees are requested to return the tins, carriage forward, to the nursery from which they were obtained, or to the Manager, Forest Nursery, Salisbury. If the tins are not returned within two months from date of issue, they will be charged for at the current rate of petrol tins; present price 4d. each.

7. No trees will be reserved unless specially booked. Orders will be executed in order of receipt as trees are ready for despatch. Every effort will be made to comply with instructions of purchasers.

8. Transplants of forest trees, when quoted at per 1,000, are grown in half paraffin or petrol tins containing 20 to 25 transplants. The average weight of each tin is about 25 lbs. Height of transplants, about 3 to 12 inches.

9. Transplants of larger size, from 1 ft. to 3 ft., are also supplied four in a tin at per tree Weight of tin, about 25 lbs.

10. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

11. To purchasers of forest trees, the following reductions are made:—

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

(c) Special quotation for orders over 20,000.

12. Orders for seed are posted or railed free of charge.

13. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

14. Intending tree planters are invited to apply to the Chief, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

15. No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants:—

A—Trees, 25 in tin, at 2s. 3d. per tin, £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

B—Trees and shrubs, 24 in tin, at 3d. each.

C—Trees and shrubs, 4 in tin, at 4d. each.

D—Trees and shrubs, 4 in tin, at 9d. each.

E—Trees and shrubs at 9d. each; extra large up to 5s. each.

Botanical Name.	Common Name.	Remarks.	Price of trans- plants.	Price of seed.	
				Lb.	Oz.
<i>Callitris calcarata</i> ...	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Resistant to white ants. Good shelter for orchards, etc.	A. C.	15s.	1s.
<i>Callitris glauca</i> ...	White cypress pine ...	Similar to <i>Callitris calcarata</i> . Better for poor acid soils and ironstone kopjes.	A. C.	15s.	1s.
<i>Casuarina Cunninghamiana</i>	Beefwood ...	A fine large shade tree, suitable for avenues and narrow belts, but not recommended for timber plantations. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A. C.	...	2s. pkt. 1s.
<i>Cedrela odorata</i> ...	...	A rapid-growing tree similar to <i>Cedrela toona</i> , but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	A.		
<i>Cedrela toona</i> ...	Toona tree... ..	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for plantations, as well as shade and ornament.	A. C.	15s.	1s.
<i>Cupressus arizonica</i> ...	Arizona cypress ...	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A. C.	15s.	1s.
<i>Cupressus lusitanica</i> ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent soft-wood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A. C.	5s.	6d.
<i>Cupressus sempervirens</i> , var. <i>horizontalis</i>	Common cypress spreading	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as <i>Cupressus arizonica</i> . Suitable for shelter and hedges.	A. C.	15s.	1s.

<i>Cupressus sempervirens</i> , var. <i>pyramidalis</i>	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar con- ditions to the "var. horizontalis."	A. C.	15s.	1s.
<i>Cupressus torulosa</i> ...	Himalayan cypress... ..	A good tree for timber and shelter. Withstands much cold and drought. Not very soil exacting. Fairly frost-hardy.	A. C.	10s.	9d.
<i>Eucalyptus botryoides</i>	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
<i>Eucalyptus citriodora</i> .	Lemon-scented gum ...	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A.	15s.	1s.
<i>Eucalyptus crebra</i>	Narrow - leaved iron- bark	A slow-growing, deep-rooting species, producing excel- lent timber. Suitable for well-drained soils in the higher rainfall areas. Withstands a certain amount of drought and light frosts. Will not thrive in an acid soil.	A	15s.	1s.
<i>Eucalyptus globulus</i> ...	Tasmanian blue gum...	A fast-growing tree, suitable for cool, moist areas with deep soils. Will not withstand drought, but is frost-resistant to a large extent. Produces a useful timber.	A.	15s.	1s.
<i>Eucalyptus maculata</i> ..	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A.	15s.	1s.
<i>Eucalyptus maideni</i> ...	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Pro- duces a good, strong, useful timber.	A.	30s.	2s.

Botanical Name.	Common Name.	Remarks.	Price of trans- plants.	Price of seed.	
				Lb.	Oz.
<i>Eucalyptus melliodora</i>	Yellow box...	A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
<i>Eucalyptus paniculata</i>	Grey ironbark ...	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
<i>Eucalyptus punctata</i> ...	Leather jacket ...	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry cold climate.	A.	15s.	1s.
<i>Eucalyptus robusta</i> ...	Swamp mahogany ...	A quick-growing, shady tree, which requires a moist soil for best results, but will grow under fairly dry conditions, provided frost is not severe. Recommended rather for shelter belts than plantations.	A.	15s.	1s.
<i>Eucalyptus rostrata</i> ...	Red gum ...	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
<i>Eucalyptus saligna</i> ...	Sydney blue gum ...	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
<i>Eucalyptus sideroxyton</i>	Red ironbark ...	A fairly slow-growing species, suitable for dry, rocky, soils in the moister regions. Produces a good, durable hardwood.	A.	15s.	1s.
<i>Eucalyptus tereticornis</i>	Forest red gum ...	Similar to <i>Eucalyptus rostrata</i> , and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.

<i>Grevillea robusta</i>	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A. C.	...	pkt. 1s.
<i>Jacaranda mimosæfolia</i>	<i>Jacaranda</i>	An ornamental tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and many need protection in its earlier youth. Semi-deciduous.	A. C.	20s.	1s. 3d. pkt. 1s.
<i>Pinus canariensis</i>	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A. C.	15s.	1s.
<i>Pinus halepensis</i>	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A. C.	15s.	1s.
<i>Pinus radiata</i> (insignis)	Remarkable pine	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions.	A. C.	15s.	1s.
<i>Pinus longifolia</i>	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. Not frost-resistant or very drought-hardy.	A. C.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed.	
				Lb.	Oz.
<i>Pinus pinaster</i>	Cluster pine... ..	Yields a useful, strong softwood. Does well on sandy soils and soils without much lime, in the better rainfall areas. Not very drought-resistant.	A. C.	15s.	1s.
<i>Populus alba</i>	White poplar	A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
<i>Populus deltoidea</i> , var. <i>missouriensis</i>	Carolina poplar... ..	A very fast-growing poplar, producing a very good timber for matches, etc. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	C.		
<i>Salix babylonica</i>	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	C.		
Ornamental Trees, Shrubs and Hedge Plants.					
<i>Abelia floribunda</i>	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
<i>Aberia caffra</i>	Kei apple	A rough, thorny, impenetrable shrub, making a good hedge. Withstands frost and drought well. Suited for all but the driest areas of the Colony. More useful than ornamental. Slow growing.	B. E.		
<i>Acacia Bailexana</i>	Silver wattle	A small ornamental tree with blue foliage and yellow flowers.	E.		
<i>Acalypha marginata</i> ...	—	Margin of leaf crimson; a shrub; will grow to 10 feet in height, or clipped to shape. Very useful to give colour to shrubbery.	E.		
<i>Agapanthus umbellatus</i>	Cape Lily	Blue and white varieties.	E.		

Aleurites fordii... ..	Tung oil	An important oil-bearing tree from China. 25 to 30 feet in height.	E.	
Aloysia citrodora... ..	Lemon-scented verberna	A small shrub with a strongly lemon-scented foliage. Hardy, vigorous, quick-growing.	E.	
Alstonia scholaris... ..	—	A white flowered shrub, 6 feet high, similar to Oleander.	E.	
Bauhinia galpinii	Pride of de Kaap	A rambling shrub, bearing orange-red flowers. Hardy.	D. E.	... pkt. 1s.
Bauhinia acuminata	Bauhinia	A large, indigenous shrub, flowering profusely in early spring. White flowers. Hardy.	D. E.	... pkt. 1s.
Bauhinia purpurea ..	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	D. E.	... pkt. 1s.
Botusanthus speciosus	Rhodesian tree wistaria	An indigenous, deciduous tree with blue flowers at the end of long stalks. Ornamental.	E.	
Brugmansia Knightii	Moonflower	A flowering shrub with large, drooping, white flowers. Strong scent (of lily). Fairly frost-hardy.	E.	
Brunfelsia eximia... ..	Yesterday, to-day and to-morrow	Shrub 4 to 6 feet. Flowers change colour from purple to white as they grow older.	1s. each	
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E.	
Buddleia sp.	Yellow buddleia	A rank-growing, yellow-flowering shrub. Useful as a hedge. Rapid-growing. Frost-tender.	E.	
Callistemon speciosus	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.C.E.	... 2s. pkt. 1s.
Carica papaya	Pawpaw	A small tree with a large, dark green foliage, bearing large edible fruits.	E.	
Casimiroa edulis	Mexican apple	A large, rapid-growing tree, 30-40 feet in height, ever-green, and bears a delicious fruit. A fine shade tree.	E.	
Cassia capensis... ..	Cape laburnum... ..	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.	
Cestrum aurantiacum	Ink berry	A small shrub, bearing orange flowers in profusion.	E.	

Botanical Name.	Common Name.	Remarks.	Price of trans- plants.	Price of seed.	
				Lb.	Oz.
<i>Crataegus oxyacantha</i>	Hawthorn	Fruits yellow. Deciduous shrub. The yellow berries hang throughout the winter.	E.		
<i>Crataegus pyracantha</i>	Hawthorn	Berries scarlet. Shrub evergreen if watered throughout the winter.	E.		
<i>Croton sylvaticus</i>	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.		
<i>Cyphomandra betacea</i>	Tree tomato	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E.		
<i>Dahlia imperialis</i>	Tree dahlia	A medium-sized shrub, making a handsome show with its single white blooms.	E.	...	pkt. 1s.
<i>Dalbergia sissoo</i>	Sissoo	A large deciduous tree from India, producing an excellent timber. Desires a deep, porous, well-drained soil in close proximity to running water. Will not tolerate stiff clay. Frost-hardy, but not very drought-resistant. Rapid-growing.	D.		
<i>Datura arborea</i>	Tree potato	A large shrubby tree, up to 30 feet in height, with large purple flowers. Very quick grower. Fruit poisonous.	E.		
<i>Deutzia crenata</i>	Bridal wreath	A small deciduous shrub with double white flowers, tinged slightly pink, on long, drooping stalks.	E.		
<i>Duranta plumieri</i>	Tree forget-me-not	A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.		
<i>Eugenia brazilensis</i>	Brazilian cherry	A small shrub, bearing orange-coloured, edible fruits. A useful hedge plant.	D.		
<i>Euphorbia splendens</i>	Christ thorn	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.		
<i>Freylinia Tropica</i>	Inyanga hedge plant	A useful hedge shrub. Indigenous.	B.		

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed.	
				Lb.	Oz.
<i>Morus</i> sp.	Mulberry	A very large fruited variety.	E.		
<i>Moschosma</i>	Rhodesia spirea	A medium-sized, blue-flowering shrub.	E.		
<i>Nerium oleander</i>	Ceylon rose	The Oleander. Salmon-pink, also a white variety.	E.		
<i>Parkinsonia aculeata</i>	Jerusalem thorn	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.		
<i>Persea gratissima</i>	Avocado pear	A shrub, with an edible fruit.	2s. 6d. each		
<i>Photinia japonica</i>	Loquat	A small evergreen tree with large leaves, bearing yellow edible fruit.	D. E.		
<i>Phytolacca dioica</i>	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle feed.	A.	...	pkt. 1s.
<i>Pittosporum undulatum</i>	Camphor laurel	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	9s. per 100 Class A.		
<i>Plumiera rubra</i>	Frangipani	A handsome shrub with pinkish red flowers. Rather delicate.	2s. 6d. each		
<i>Plumiera occulata</i>	—	Similar to <i>Plumiera Rubra</i> with white flowers.	2s. 6d. each		
<i>Poinciana regia</i>	Flamboyant	A handsome red flowering, feathery foliaged tree.	D.		
<i>Poinsettia pulcherrima</i>	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also pink variety.	E.		
<i>Poinsettia albida</i>	Poinsettia	As above, but with yellowish white bracts. Double and single varieties.	E.		
<i>Psidium pomiferum</i>	Guava	A small, hardy, evergreen tree, bearing edible, yellow fruit.	D. E.		

<i>Punica granatum</i>	Pomegranate	A shrub or small tree, having shining leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.	
<i>Rhus lancea</i>	Karreeboom... ..	A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.	10s. 9d.
Roses (bush)	—	An assortment of roses of about fifteen kinds, Teas, Hybrid Teas and Hybrid perpetuals, are usually on hand at 1s. each. These roses are struck from cuttings, but are not named.	E.	
<i>Russelia juicea</i>	Coral fuchsia	A pretty red-flowered shrubby plant about 6 feet high.	E.	
<i>Salvia involucra</i>	Salvia	Shrubby herbaceous perennial, growing to six feet in height. Red flowers. Very suitable for cutting.	E.	
<i>Spathodea campanulata</i>	African flame tree... ..	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils.	E.	
<i>Spirea prunifolia</i>	Cape May... ..	White flowered shrubs four feet in height, in single and double varieties.	E.	
<i>Streptosolon Jamesonii</i>	Streptosolon... ..	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.	
<i>Strobilanthus</i> sp.	—	A shrubby herbaceous plant covered with intense blue flowers in the Autumn. 3 feet high.	E.	
<i>Tecoma Smithii</i>	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A. E.	pkt. 1s.
<i>Thevetia nerifolia</i>	Thevetia	An evergreen shrub, bearing bell-shaped, yellow flowers. Hardy.	E.	
<i>Thuja orientalis</i>	Thuja	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A.C.	pkt. 1s.

Climbers and Creepers.

Botanical Name.	Common Name.	Remarks.	Plants each.
<i>Ampelopsis veitchii</i> ...	Virginia creeper ...	Too well known to need description.	E.
<i>Antigonon leptopus</i> ...	Coral Creeper ...	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.
<i>Aristolochia elegans</i> ...	Dutchman's pipe ...	A rank-growing creeper. Heart-shaped leaves. Crimson flowers, spotted yellow.	E.
<i>Aristolochia tomentosa</i>	Dutchman's pipe ...	A rapid-growing climber, with crimson purple flowers.	E.
<i>Beaumontia grandiflora</i>	Beaumontia ...	A large climber with heavy, glossy foliage. Large white, bell-shaped flowers. Blooms profusely. Fairly frost-tender.	1s. 3d.
<i>Bignonia venusta</i> ...	Golden shower ...	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	1s. 3d.
<i>Bignonia speciosa</i> ...	Bignonia ...	A rapid-growing, showy creeper, bearing large mauve flowers. Decumbent.	E.
<i>Bougainvillea splendens</i>	<i>Bougainvillea</i> ...	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	1s. 3d.
<i>Ficus repens</i> ...	—	A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.

Botanical Name.	Common Name.	Remarks.	Plants each.
<i>Hedera helix</i> ...	Ivy ...	A dark evergreen climber. Best in shady, cool climates.	9d.
<i>Jasminum sambac</i> ...	Jasmine ...	A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers.	1s. 3d.
<i>Jasminum primulinum</i>	Climbing jasmine ...	A yellow-flowering species similar to <i>Jasminum grandiflorum</i> .	9d.
<i>Lantana salviaefolia</i> ...	—	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
<i>Lonicera periclymenum</i>	Honeysuckle (Woodbine)	Hardy climber with sweet-scented flowers, yellow inside, reddish purple outside.	9d.
<i>Lonicera sempervirens</i>	Red honeysuckle ...	Climber with red flowers. Best kept well pruned or base becomes ugly.	9d.
<i>Mandevilla suaveolens</i>	Mandevilla ...	Deciduous climber, bearing trumpet-shaped, white, fragrant flowers. Very slender.	9d.
<i>Passiflora edulis</i> ...	Granadilla ...	A quick-growing climber, bearing edible fruits. Subject to woolly aphids if overshadowed. A good trellis plant.	E.
<i>Passiflora</i> sp. ...	Fiji granadilla ...	A large-leaved climber, bearing yellow fruits. Flowering well. A good trellis plant.	E.
<i>Podranea Brycei</i> ...	Zimbabwe creeper...	A rank-growing indigenous creeper with large, pink flowers.	E.
<i>Rosa bracteata</i> ...	Macartney rose...	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
<i>Solanum Wenlandii</i> ...	Blue potato creeper ...	A rapid-growing creeper with tubular, blue flowers. Not frost-hardy.	E.
<i>Wistaria chinensis</i> ...	—	The well-known climber with lavender coloured panicles of flowers. Purple, and blue kinds also in stock.	E.

Palms, Bamboos, etc.

<i>Arundo donax</i>	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d. each
<i>Bambusa fortunei</i>	Fortune's bamboo	A small variety, 6 feet high, with canes about the thickness of a lead pencil, extremely useful for stakes in the garden.	Offsets 2s. 6d. each
<i>Bambusa arundinacea</i>	Whipstick bamboo	About 30 feet.	Offsets 2s. 6d. each
<i>Bambusa</i> sp.	Japanese striped bamboo	A very ornamental variety with golden rods marked and striped with green lines, about 20 feet.	Offsets 2s. 6d. each
<i>Bambusa</i> sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Seedlings 9d. each
<i>Chamaerops excelsa</i> ...	Fan palm	Suitable for shrubberies, etc.	—
<i>Cortaderia argentea</i> ...	Pampas grass	With long white plumes about 6 feet in height; must be grown near water or close to a tap.	Seedlings 9d. each Offsets 2s. 6d. each
<i>Cyperus papyrus</i>	Papyrus Grass	A very handsome subject for the water garden, or planted near the drip of a tap; it does best when growing in the water.	2s. 6d. each
<i>Oxytenanthera abyssinica</i>	The Bindura bamboo ...	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Seedlings 9d. each
<i>Phoenix reclinata</i>	Date palm	A very hardy palm, indigenous to the Colony.	—
<i>Phormium tenax</i>	New Zealand flax	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
<i>Washingtonia robusta</i>	Fan palm	A strong-growing fan palm.	—

Palms 2s. 6d. to 5s. each.

Offsets of Bamboos supplied during January only.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 35. October, 1935.

The locust position during October has shown little change.

The only species reported are of the red species (*Nomadacris septemfasciata*, Serv.).

Swarms have been described as "Enormous," "Very large," "Large," "Small" and "Very small," mostly from the eastern portion of the Colony.

The following districts are included :—Melsetter, Umtali, Rusapi, Chibi, Victoria, Marandellas, Charter, Gwelo, Sebungwe, Matobo, Nyamandhlovu, Insiza, Plumtree and Bubi.

From the specimens received the breeding colouration is developing, likewise the ovaries in the females.

There has as yet been no indication of a southward pre-breeding migration from the Colony.

Extensive damage to crops, gardens and fruit trees has been reported from Melsetter.

No reports of disease or parasites have been received and specimens submitted to this office have been healthy.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Weather Bureau.

OCTOBER, 1935.

Barometric Pressure.—The general level of pressure was high throughout the first part of the month, and in spite of a falling off after the 20th, mean monthly pressures were for the most part about 1mb. above normal.

Temperature.—Temperatures throughout the month were fairly uniform, the coolest days being the 5th, the 16th, the 25th and the 26th. The highest maximum temperature recorded occurred, in general, on or about the 28th.

Rainfall.—Apart from occasional drizzle in the east, the first part of the month was dry. Thunder showers occurred over a fairly wide area on the 22nd, and again from the 27th to the 31st.

Farming Calendar.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of *Cedrela toona* seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning, and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant. or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Warm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutabilis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), $1\frac{1}{2}$ ozs.; molasses, $\frac{1}{2}$ gallon, or cheapest sugar, $2\frac{1}{2}$ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gunis, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the season. The growing period is at its height, and high temperatures are registered.

THE RHODESIA
Agricultural Journal.



Issued by Authority of
the Minister of Agriculture and Lands.

VOLUME XXXII.

1935.

PUBLISHED MONTHLY.

PRINTED BY THE ART PRINTING WORKS, LTD., SALISBURY, S. RHODESIA.

The Rhodesia Agricultural Journal.

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